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Editor
U. Baliol Scott
Deputy Editor
A. Graham Thomson
Assistant Editor
R. Bowran

Display Advertisement Manager
E. S. Hooper
Circulation
Robert Budd

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E. Baliol Scott
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Americans Blame Japanese for Copper Crisis

UNDER Mr. Ikeda's expansionist regime, Japan was set the goal of doubling her economy within the next decade. Although the growth of the Japanese economy during the past three years has been the most hectic in world history, achievement of the present target calls for continued expansion at the rate of 9 per cent annually for a further three years. Japanese metal interests have accordingly been scouring the world in search of the raw materials necessary to support the projected increase in industrial capacity.

As indicated in our issue of June 9, 1961, p. 653, Japan's imports of copper, lead and zinc are soaring and the methods by which she is seeking to expand her own smelting and refining capacity are alleged to be disrupting the established pattern of international trade. According to the Japan Mining Association, Japanese copper smelters are now importing nearly half of the copper ores available in the international market and their requirements are still increasing rapidly. Japanese imports of copper and brass scrap have also been rising very steeply in the past two years.

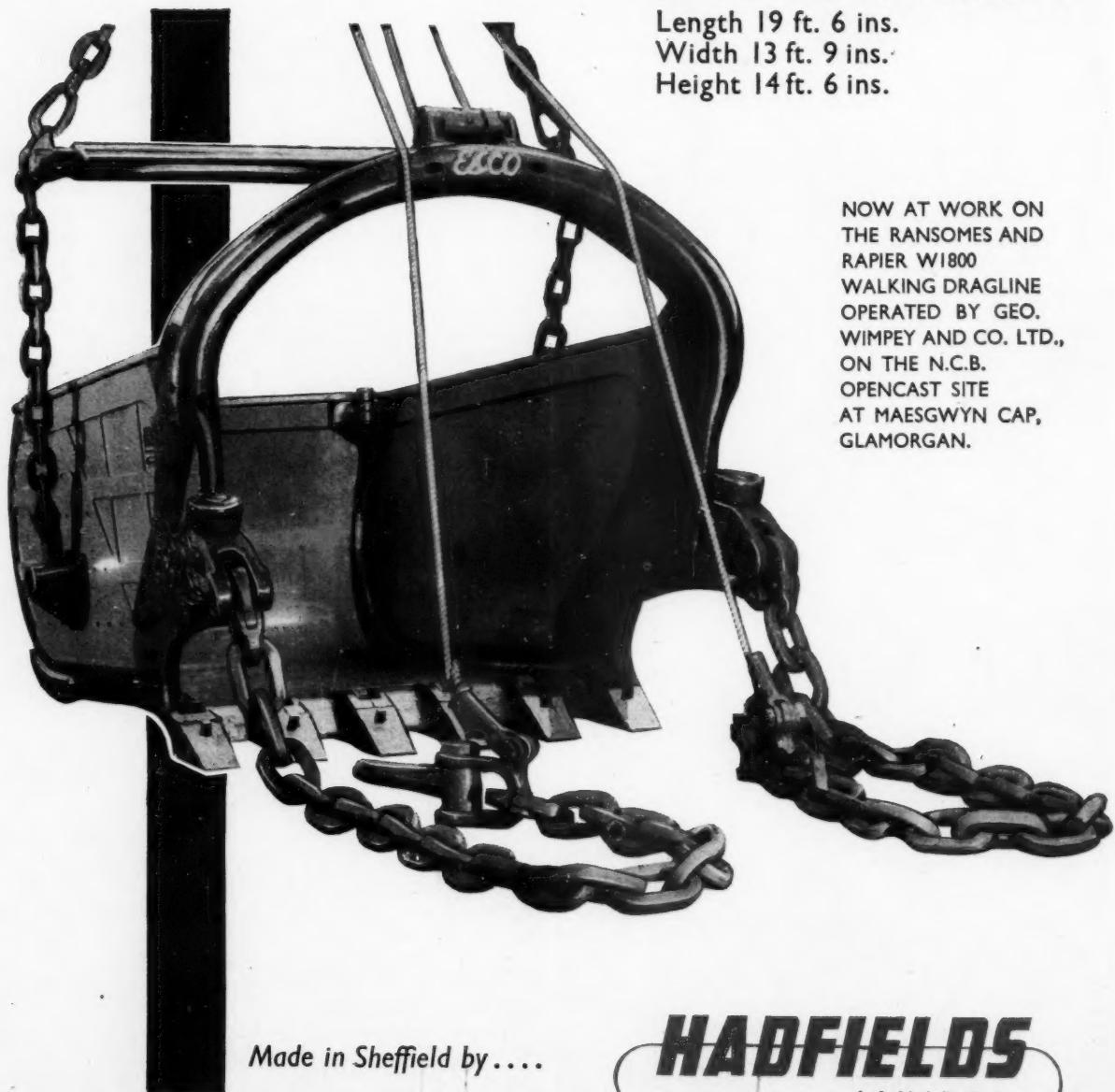
In order to subsidise the smelting and refining of copper in Japan, Japanese consumers are forced to buy refined copper in the domestic market at about 5 c. per lb. above the world price. This high domestic price level is maintained by a 10 per cent tariff on refined copper and by limiting the allocation of foreign exchange. Recently, restrictions on imports of refined copper and alloys were further tightened. Scrap copper pays a lesser duty than refined metal, while ores and concentrates are on the free list, as are copper based alloy scraps. As a result of these artificial conditions, Japanese smelters are able to outbid smelters in other countries for copper concentrates and copper scrap.

Most countries other than the United States limit exports of copper and brass scrap for the benefit of their own smelters; hence the bulk of Japanese scrap purchases have been concentrated in the United States. Since 1958 the annual rate of U.S. scrap exports has quadrupled and this has been mainly accounted for by a more than tenfold increase in the rate of exports to Japan.

According to a memorandum issued by the International Union of Mine, Mill and Smelter Workers (Mine-Mill Research Department), Japanese competition for copper raw materials—which the union terms "unfair and illegal"—has reached such proportions as to constitute a serious threat to the continued operation of American smelters of primary and secondary copper, especially those located at or close to tidewater. This situation is described as jeopardising the jobs and earnings of more than 10,000 U.S. workers employed in the 72 secondary copper smelters and the 12 primary smelters (out of a total of 20), which operate in part on purchased scrap.

The memorandum points out that Japan's deep incursion into international copper concentrate and scrap markets has affected American custom smelters in two ways. Smelters operating on foreign concentrates have found it increasingly difficult to bid against Japanese smelters which have access to a subsidised domestic

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market and accordingly can pay more than American or foreign smelters. The Japanese have been able to pre-empt virtually the entire mine production of copper concentrates in British Columbia, despite the much shorter all-water haul to the Tacoma, Washington, smelter. They have successfully outbid the Tacoma smelter for concentrates from Mt. Isa in Australia (53 per cent owned by A.S.A.R.C.O., which owns the Tacoma smelter). They have also outbid American Metal Climax for concentrates produced in South-west Africa by the Tsumeb Corporation, which is 29.13 per cent owned by American Metal Climax.

The U.S. smelters principally affected by Japanese competition for foreign concentrates are the Tacoma smelter and the American Metal Climax smelter at Cartaret, New Jersey. Tacoma has been operating at about two-thirds of the 1953-58 rate, when Japanese concentrate imports averaged less than one-fourth the current volume. According to press reports it may soon shut down completely until a backlog of concentrates can be built up. The Cartaret smelter has already shut down its reverberatory furnace and concentrate smelting operations because of inability to buy foreign concentrates.

The closing of the Tacoma smelter would be a death blow to a major segment of the independent copper mining industry in the North-western States, because Tacoma is the only reduction facility open to arsenical or other refractory type ores found in the region. Kennecott does not treat custom ores, while Anaconda's Montana smelter does not treat refractory ores. The nearest available custom smelters are in southern Arizona—a long and prohibitively expensive haul.

At the same time Japanese scrap-buying operations have driven up the U.S. price of scrap, have curtailed supplies available to custom smelters and to primary smelters which add scrap to concentrate feed, and have led to layoffs at numerous plants. As long ago as January, the Phelps Dodge plant on Long Island was operating with a reduced labour force. Other layoffs that have occurred or are threatened due to short scrap supplies have been reported to the union from a number of widely scattered points throughout the United States.

In discussing the adverse consequences of this form of Japanese competition, the memorandum draws attention to the inflation in the U.S. price of scrap in relation to the price of refined copper, and the effect of this scrap price inflation on the price of refined copper. Between January 7, 1960, and September 7, 1961, it is stated, the spread between No. 1 scrap and refined copper narrowed from 4.613 c. to 2.25 c. and that between No. 2 heavy scrap and refined copper from 8.113 c. to 5.25 c. Thus the spread between No. 1 scrap and refined copper on September 7 was less than 50 per cent of the spread in January, 1960, while that between No. 2 heavy scrap and refined copper was about one-third less.

The narrowest spreads were reported on April 27, 1961, at 1.75 and 3.75 c. respectively for No. 1 and No. 2 heavy scrap. The following week the producers' price of refined copper was advanced by one cent, and it rose by an additional cent to 31 c. during May. Yet, as the memorandum recalls, during the four months preceding these price increases, U.S. consumption of refined copper had been the lowest in several years other than the depression year of 1958. Moreover, Anaconda, Phelps Dodge, Inspiration and Copper Range were operating on a reduced scale and their 10 per cent cutbacks remained in force for several months thereafter. Kennecott, too, had been on a similarly reduced scale until April 13. The conclusion is inescapable, states the Union, that in this situation Japanese bidding up of the price of scrap had a decisive influence on the price of refined copper.

The situation that has arisen in the United States is of

obvious concern to the copper industry throughout the world. In the U.S. copper is the only major metal other than tin (and recently nickel) to have experienced a price increase this year. Competitive metals such as stainless steel and zinc have become cheaper. Aluminium has held stable, while a leading competitive plastic was cut by 20 per cent. Though there has been some tendency, lately, for the U.S. market, price-wise, to "gang its ain gait," it is evident that in all but the short run the Free World market is fundamentally an integral unit. Continued pressure on U.S. scrap prices as the result of Japan's ability to outbid American custom smelters could scarcely fail to be reflected in the level of L.M.E. prices, while a weakening in the United States of copper's competitive position *vis-à-vis* alternative materials would soon be paralleled throughout the world.

The International Union of Mine, Mill and Smelter Workers calls for a three-fold programme of action to remove the threat to American smelters. It suggests, in the first place, that the Secretary of Commerce should exercise his authority under the Export Control Act of 1949 to limit U.S. exports of copper and copper base scrap. Secondly, the memorandum alleges that the Japanese Government is violating its international treaty obligations under G.A.T.T. by imposing quantitative restrictions on the importation of refined copper through the device of foreign exchange allocation. It urges that the State Department should make the strongest representations to the Japanese Government with a view to ending these restrictions, and that this matter should be taken up in conjunction with the proposal to impose controls on U.S. exports. Finally, it is suggested that U.S. Cabinet officers, when in Japan later this autumn, should renew attempts to end the present discrimination.

It seems conceivable that the changing situation in Japan itself, where the payments position has been deteriorating and the Cabinet have recently decided to slow down the rate of growth, might render the Japanese Government more sympathetic to representations on the lines proposed. This year expansion in Japan has been running at something like twice the 9 per cent originally anticipated and steel manufacturers were recently asked by the government to cut back their capital investment programmes, besides increasing their exports. Similar measures applied to copper would involve a substantial modification of present import policy which, in the long run, might well prove to be in the interests of all concerned.

EXPANSION OF NEYVELI PROJECT

Substantial expansion of the mining as well as power potential of the integrated Neyveli project has been proposed in India's Third Five Year Plan. The output of lignite, for which a target of 3,500,000 tons was set in the Second Plan, is to be increased to 4,800,000 tons, at a cost of Rs.38,000,000. The foreign exchange component of the programme is Rs.14,500,000.

The capacity of the thermal power plant, which had been fixed at 250 megawatts in the Second Plan, is to be stepped up to 400 megawatts, involving a capital outlay of Rs.150,000,000 and a foreign exchange expenditure of Rs.99,300,000.

It is believed that the special mining equipment to be obtained for the expansion programme would be sufficient to raise the output of lignite even to 6,000,000 tons. Additional lignite would be needed in due course to feed the proposed high temperature carbonisation plant for the production of lignite coke.

The Neyveli project comprises a fertiliser plant for the production of 70,000 tons of fixed nitrogen in the form of urea, a briquetting carbonisation plant for producing 380,000

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With the uncovering of the lignite seam at one end of the open cut mine at the Neyveli mines recently, authorities are planning to open up a 750,000 square feet lignite bed during the next two months and prepare for mining of lignite from this area for use in the first unit of the thermal power station next December, according to official sources. They disclosed that it has been planned to prepare a dispatch of 2,000 tons of lignite as laboratory sample to institutes outside India.

The uncovering of the lignite seam was made possible by the effective control of the pressure from artesian aquifers in the mine area through a carefully planned system of deep wells. These wells are 100 feet deeper than the lignite bed and pumps take out 1,000 gallons of water per minute from each of them.

ECONOMIC INTEGRATION IN EASTERN EUROPE

According to the Institute for the Study of the U.S.S.R., an organisation based on Munich that keeps track of developments behind the Iron Curtain, Russia's ambitions to become the world's foremost industrial power could not be realised in the foreseeable future without the help of the seven Eastern European satellites—East Germany, Poland, Czechoslovakia, Rumania, Bulgaria, Hungary and Albania. These countries have a combined population of more than 100,000,000 and their potential contribution to Russia's economic strength is clearly immense. Already the satellites produce one-third as much steel as Russia herself, nearly as much coal, and about 40 per cent as much electrical energy.

Russia is reported to be stepping-up its efforts both to expand industrial production in the satellites and to weld the economies of the individual countries more closely together to form a single self-dependent unit. In line with this policy, State planners are drawing up ambitious 20-year plans for each country in accordance with a co-ordinated programme of development which will dovetail with the 20-year plan recently announced by Russia itself. Economic considerations apart, this policy has the advantage to Moscow of making it more difficult for any satellite to follow Yugoslavia's example and break away from the bloc.

The agency entrusted with the responsibility of tying the satellites more closely to Russia is the Council of Mutual Economic Assistance, often referred to as Comecon, whose activities were reviewed in our issue of February 24, 1961, p. 211. Comecon has 14 standing committees, each of which looks after a particular section of the bloc's economy, such as coal, chemicals, and non-ferrous metals. At the present time the production of oil drilling equipment is being concentrated in Bulgaria and Russia; aluminium output in Hungary and Czechoslovakia; copper smelting in Bulgaria and Czechoslovakia. East Germany is rendering economic assistance to Poland in the development of brown coal extraction. Czechoslovakia is co-operating with Poland in extracting hard coal and sulphur, while Czechoslovakia and Albania are working together in the extraction of nickeliferous Albanian ore; Russian technicians are helping Rumania to build a steel mill, East Germany is sharing its chemical know-how with other satellite countries.

Such is the degree of self-sufficiency already achieved by the Comecon countries that today about 70 per cent of the satellites' trade is within the bloc and only about 30 per cent with the rest of the world. This pattern is almost exactly the reverse of that which existed before Russia started to integrate the economies of the satellites with its own. According to *The Wall Street Journal*, Hungary now receives 96 per cent of its crude oil and 97 per cent of its iron ore from Russia, Czechoslovakia depends on Russia for 99 per

cent of its crude oil, while Bulgaria, which imports 60 per cent of its steel, gets much of it from Russia.

It is evident that the integration of the satellite economies with that of Russia, as carried out under the aegis of Comecon, will have a profound influence on world commodity markets, one probable consequence being an increasing demand on the Soviet's mineral and metal resources to meet rising consumption within the bloc. It is not inconceivable, therefore, that with the expansion of industrial production and intertrading within the bloc, the time may not be far distant when Western markets will no longer be disrupted periodically by heavy exports of metals and minerals from Russia and Eastern Europe.

AUSTRALIAN IRON ORE AND COAL EXPORTS

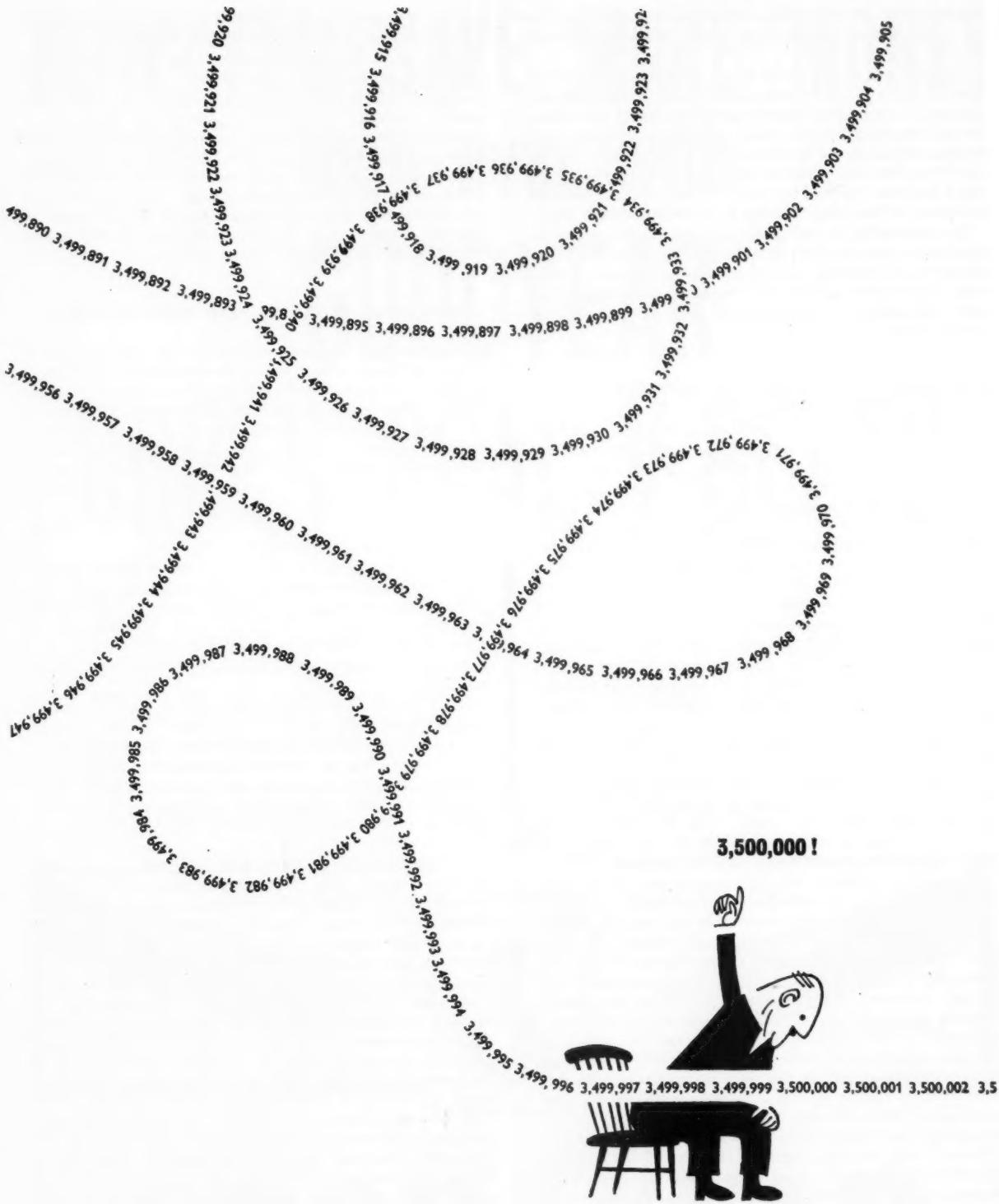
Some setback has been suffered in the iron ore export project in Western Australia by the withdrawal of Japanese interest in the provision of capital for the development of the Mount Goldsworthy iron ore deposit because of discrepancy of figures of supposed tonnage and grade of ore. The preliminary estimate of tonnage was 30,000,000 tons; but this figure has, apparently, been unsupported by more detailed examination and there is wide difference in estimates of grade. The Japanese are willing, however, to buy ore of the required grade. A further adverse factor was the unsuitability of the harbour of Port Hedland.

Western Mining Corporation has entered into agreement with the Western Australian Government to mine and ship 2,000,000 tons of iron ore from the Tallering Peak deposit 100 miles north-east of Geraldton. This enterprise will involve an expenditure of £A2,250,000, and the construction of a railway, which, with shipping facilities, will call for £A1,200,000.

Much attention is being given to the search for iron ore deposits suitable for export, and the discovery of an occurrence has been reported at Mount Wells, 140 miles south of Darwin and close to the North Australian railway, but authentic information is not yet available. Queensland is entering the export trade and the Commonwealth Government has approved the export of 200,000 tons from a deposit near Townsville.

Full development of export trade from New South Wales to Japan depends upon the modernisation of harbour facilities and loading equipment for the needs of the large colliers planned for the trade. There has, consequently, been satisfaction in the statement that the Commonwealth Government will give financial assistance to the New South Wales State Government up to £A2,650,000 for the provision of coal loading plant and equipment, but the responsibility for harbour improvement rests on the State Government. Since the announcement of Commonwealth aid for coal exports, it has been decided to defer the proposed off-shore loading project at the Coal Cliff Colliery, in New South Wales. The delay in coming to a decision about the location of the modern loading plant at Newcastle, and also in the commencement of construction elsewhere is regrettable. In the meantime American producers are ready to ship coal to Japan. The chairman of the Australian Coal Association has warned that there will be increasing competition with America for the Japanese trade. Large orders are available and the threat of undercutting in price is very real.

The New South Wales Minister for Works has announced that coal loading facilities, costing £A2,500,000, will be built in the inner harbour at Port Kembla, and that dredging will be carried to a depth of 38 ft. to berth ships of 35,000 tons. Facilities will permit the loading of the largest carriers in 24 hours. Planned equipment includes equipment for mechanical trimming and automatic weighing. Completion is scheduled for 1963.



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India's Copper Resources

AT a recent symposium on copper sponsored by the Geological Survey of India, several speakers stressed the need to step up production of copper in the country. In view of the low production of indigenous copper, measures to raise production were discussed by many delegates. These included the employment of latest scientific techniques, such as geophysical and geochemical methods, exploitation of low-grade ores, and the extension of survey work in other zones. It was generally felt that the exploitation of copper in the Khetri and Singhbhum belts must be given the highest priority. About 250 delegates from all over India representing the industry, government departments, universities, and research institutions attended the symposium.

Inaugurating the proceedings, Mr. N. N. Kashyap, joint secretary, Union Ministry of Steel, Mines and Fuel, underlined the importance of self-sufficiency. He pointed out that India's imports of base metals such as copper, lead and zinc were rapidly increasing in view of her industrialisation programme. In 1951 the total imports of copper, lead, zinc and nickel were valued at about Rs.113,700,000. In 1959 the value of imports of copper, lead and zinc alone shot up to Rs.225,000,000, and in 1960 increased still further to Rs.360,000,000, of which the value of copper imports alone accounted for Rs.240,000,000. In 1960, India imported 164,000 tons of copper, lead and zinc against 128,000 tons in the previous year.

Mr. Kashyap said that an all-out effort was necessary to raise the country's copper production so that the available resources could be put to the best use and valuable foreign exchange saved. There was only one copper-producing unit in the country—the Indian Copper Corporation's plant at Ghatsila—where the production was more or less stagnant around 8,000 tons a year. He stated that the public sector plant at Khetri would soon go into production and another unit, formed in collaboration with the Sikkim Government, would also be commissioned. The Government had estimated the consumption of copper at about 180,000 tons by the end of the Third Plan period. Although India's *per capita* consumption of copper was only 0.02 lb. at present this was expected to be raised to 0.4 lb. by the end of the Third Plan period. In the U.S.A., the *per capita* consumption of copper was 17 lb. while in Europe it was 5 lb. Mr. Kashyap also referred to the recent find of copper ore reserves in the Roam-Sideswar block of Singhbhum district in Bihar estimated at 15,000,000 tons of ore, containing 2 per cent copper at a depth of 600 metres from the surface, and also in certain districts of Rajasthan, Madras and Andhra Pradesh.

Self-sufficiency in Copper

Mr. H. R. Dewan, director, the Indian Bureau of Mines, presented a paper prepared in his department, highlighting the possibilities of attaining self-sufficiency in copper in about 15 years' time (end of the Fifth Five Year Plan), when it would be possible to produce 300,000 tons of copper a year. He pointed out that this production level could be attained by 1976, if at least two to three large low-grade deposits were discovered in the course of the proving operations proposed to be carried out by the Bureau of Mines. In the light of the experience gained by the Bureau in the course of their detailed proving operations and reconnaissance survey in a number of copper prospects, the chances of finding large low-grade deposits appeared to be good. Mr. Dewan said: "It will be possible to step up the anticipated

production of 27,000 tons by the end of the Third Five Year Plan to 100,000 tons by the end of the Fourth Five Year Plan. To achieve the target of 300,000 tons a major leap forward in production will have to be taken in the Fifth Five Year Plan. To bring this about, the scale of exploratory and proving operations in the Fourth and Fifth Five Year Plans will have to be enormously increased. During the Third Five Year Plan, the Bureau will be conducting proving operations in eight copper prospects concurrently. This scale of operation will have to be stepped up to 30 during the Fourth Five Year Plan.

"Under suitable conditions, by open cast methods, low-grade ores running around 0.5 per cent copper, have been mined economically. The average grade of ore mined in the U.S.A. from open cast mines in 1957 was 0.72 per cent copper. It has been possible to mine low-grade ore of 0.72 per cent with an overburden ratio of 3:1. There have been great technological advances in the recovery of copper from the sub-marginal grades of ore by the leach-precipitation-flootation process, bacteria leaching, etc. Large tonnages of such sub-marginal ores, which hitherto have been considered as wastes, are now potential sources of metal. A comparative study of the cost of large scale open cast mining for the low grade ores and selective mining of richer portions shows that not only is the unit cost per ton of ore mined but also the cost per pound of metal produced less in the case of large-scale open cast mines.

Strategy of Exploration

"The broad strategy of exploration for copper should take into account the immediate need for self-sufficiency as well as the long range requirements. The prospects in Rajasthan, Singhbhum and other areas on the plains should receive greater attention because of their importance in relation to the immediate problem of achieving self-sufficiency. But at the same time proving operations should be undertaken in the Himalayan terrain, specially in Sikkim, Jammu and Kashmir, and Kulu Valley to ensure that production from these sources reaches sizeable proportion by the time difficulties are experienced as a result of depletion of the resources in the prospects on the plains."

Work of Base Metal Unit

Reviewing the work of the Base Metal Unit of the Geological Survey of India (G.S.I.), Dr. A. G. Jhingran, deputy director of G.S.I., suggested a four-point plan for increasing the indigenous production of copper. It included utilisation of low-grade ores in all the workable fields, even as a somewhat protected industry; conservation of available copper for essential purposes and increasing the use of substitutes wherever feasible; recovery as by-products of the useful elements; and encouragement of extensive research for developing substitutes for copper from material of preferably local origin.

He estimated that for every 10,000 tons of copper produced it would be possible to recover by-products including sulphur, selenium, and nickel, the total value of which at the current market rates would be worth Rs.4,000,000, the cost of copper being Rs.30,000,000. This would enable economising on the working costs, he said.

Shri S. P. Nautiyal of the Geological Survey, along with his colleagues, described the results of detailed mapping and exploration for copper in the Singhbhum belt, where some

promising zones had been found. Although the data available was not enough to determine the available reserves at this stage, it was roughly estimated that about 15,000,000 tons of copper ores bearing an average of 2 per cent copper would be available in the block around Roam, which is about 25 kilometres, north-west of the existing copper mines of Mosaboni.

The possibility of finding extensive low-grade deposits in the Himalayas was discussed in another paper. The detailed work that was being done for the investigation of copper in Sikkim was outlined. The geological potentiality of the Khetri Copper Belt and the deposits of copper in South India were also discussed.

Association of Uranium

Shri K. L. Bhola, of the Department of Atomic Energy, said that uranium was intimately associated with copper in

greater or lesser amount throughout the Singhbhum "Thrust Belt", e.g., at Mosaboni and Badia mines of the Indian Copper Corporation, Rakha mines, Roam, Jaduguda uranium mine, etc. Similar close association had also been observed in Rajasthan in the well-known Khetri Copper Belt, Dariba Mine, Umra Mine and in some other parts of India. He explained that the possibility of winning uranium, as a by-product of copper mining, was being explored to enable some of the low-grade copper deposits to be worked economically and incidentally to augment the supply of uranium from indigenous sources. Similarly, any copper ore mineral associated with uranium ores should be conserved, he added.

Shri L. N. Kailasam, of the Geological Survey of India, discussed the application of geophysical methods to exploration for copper ore in India. He stated that the electrical and electro-magnetic methods, supplemented wherever feasible by magnetic observations were generally the most useful in the search for copper deposits.

Statistical Analysis of Sample Data

In recent years many mining companies have recognised that their chance for continued economic survival depends on the adaptation of technological advances in their operations. Increased productivity through new developments in mining methods and improvements in equipment has made mining and processing of lower grade ores possible. Cost analysis has produced accurate data on the costs for development, production, and processing of ore. All these changes and cost studies have shown the necessity for increased accuracy in determining the grade of ore.

Methods of estimating grade in a mineral deposit have not kept pace with the technological advances in the other areas. The same methods are in use today as in the past. Experience and judgment are major criteria of accuracy and the results are highly subjective.

In 1953, as part of its research programme to develop a better understanding of fundamentals of mining technology, the U.S. Bureau of Mines began a sampling method research project at its Denver Mining Research Centre. The basic objective of the project was to investigate sampling methods and to study the adaptation of the techniques of statistical analysis to mine sampling. The progress of this investigation is described in "Statistical analysis of sample data for estimating ore" by Scott W. Hazen, Jr., issued as U.S. Bureau of Mines Report of Investigations 5835.

Sampling methods research by the Bureau has been directed toward developing methods that will place the estimation of grade of ore and related problems on an objective basis. This does not imply that the need for experience and judgment is eliminated, but an attempt has been made to substitute mathematical techniques for guess-work. By using these techniques of statistical analysis, more information can be obtained from the sampling data.

The techniques of statistical analysis are not a simple and complete answer to all sampling problems, states the report, but they are an added tool for use in mining engineering. Perhaps the techniques cannot be applied to all deposits because of limitations in obtaining random sample data.

Investigations by the Bureau have adapted statistical methods for determining:

1. Whether the assay data are random.
2. The precision of the estimate of grade of ore.
3. The change in the precision of the estimate of grade resulting from the changes in the number of samples or in the sample volume.

4. The combination of sample volume and number of samples of that same volume required to obtain a desired precision in the estimate of the grade.
5. The effect of core loss on the assays.

Results of some of these investigations have been published.

Conclusions

In this report the relationships between fiducial interval, number of samples, standard deviation, and sample volume are examined with reference to the assay frequency distribution of 43 phosphate shale samples from the bedded phosphoria formation in S.E. Idaho. It is concluded that such relationships should prove useful in planning sampling programmes.

If one set of sampling data were available to use as a control sample, the variance-sample volume relationship could be used to construct a curve of expected standard deviations for various sample volumes. As the drilling progressed, different sample volumes could be used to check positions of new standard deviations on the curve. Also tests for randomness could be made as the drilling progressed into new areas. When the requirement of randomness had been verified, the curve could be used to plan sampling programmes. Expected standard deviations could be determined for different sample intervals and hole diameters (sample volume). The expected standard deviations could be transferred to the graphs of the fiducial interval curves. This would determine the number of samples for each of the sample volumes that would produce the required fiducial interval and, therefore, the precision of the sampling. The problem then becomes one of determining costs of drilling and comparing the total costs for the required footage of drilling corresponding to the required number of samples for each sample volume. This is assuming that the original sample data used to obtain the data for prediction purposes are an unbiased and representative sample. It also assumes that the new samples will be distributed over the ore-body so as to constitute representative samples.

Obviously this is a simplified example. There will be additional considerations such as access to drilling and related sample data that may be desirable to obtain. However, the principle is illustrated by the example and it should provide a much more realistic decision as to the costs for a specific sampling programme.

Australian Research on Mineral Processing

THE Division of Mineral Chemistry in Melbourne is concerned with application of the principles of chemical research to the efficient and economic utilisation of minerals and their derived products, whether these are metals or non-metals. In some instances the Division's research projects are financially sponsored by industrial establishments but in others, particularly the more fundamental investigations, this is not so. A wide range of projects is currently under investigation, including studies on the extraction and recovery of rarer metals such as gold, zirconium and thorium.

Among the many projects currently being investigated in Australia by the Commonwealth Scientific and Industrial Research Organization, particular interest attaches to those relating to studies on the extraction of the rarer metals, the development of an acid process for the production of alumina, and the hydrometallurgy of gold. Australian research on minerals treatment is described in the latest Research Review of the C.S.I.R.O. for the year ended June 30, 1960

Alumina

Considerable progress was made during the year 1959-1960 with the development of an acid process for the production of alumina from various raw materials. Much further detail has been gathered with regard to this acid process, which was first mentioned in the report for 1958-59. Preliminary costing has been carried out, using a flow sheet based on fully cyclic operation. Present indications are that reagent costs are considerably less than those for the conventional Bayer process, but that capital costs for the necessary corrosion-resistant equipment are high. Investigations are now being conducted with a view to reducing equipment costs by the use of different materials of construction and by adopting improved chemical techniques which would permit a greater output from a given size of plant.

The process has also been tested with clays and aluminous laterites and shows promise of being readily applicable to these materials, which cannot be economically treated by the alkaline Bayer process. To this end, a survey is being conducted on various low-grade bauxites from Australian localities, to ensure that all stages of the process can be satisfactorily applied. Other aspects of the work are connected with the effect of alkali metals on the overall cyclic process, since these have caused undesirable contamination of the final product (alumina) in most other acid processes. The recovery of valuable minor constituents from the aluminium ores is also being studied, since in many instances these could build up to useful concentrations in the C.S.I.R.O. process.

Early studies in the Division on the extraction of thorium from monazite resulted in an economic process for recovering rare earths and thorium. The recent discovery in Canada of a large source of cheaply recoverable thorium has emphasized the need for a more direct, lower-cost process if thorium is to be extracted from local resources at a price even approximately competitive with that of imported material. Technical and economic aspects of the problem have therefore been re-examined and a promising new process developed. The new process is characterised by a minimum number of operations for extraction of thorium and by the use of the cheapest available chemicals. Rare earth by-products need not be processed unless a suitable market is developed. Ample information is now available to produce thorium in Australia as soon as a demand arises.

Hydrometallurgy of Gold

Work on the hydrometallurgy of gold has been continued with the financial support of the Chamber of Mines of Western Australia. Inefficiency in the process of cyanidation may occur as a result of a diminution in the supply of dissolved oxygen

or of "free" (i.e. uncomplexed) cyanide, the diminution being caused in both instances by impurities present in the ores. There is no doubt that substantial savings would be effected if the mines had methods of automatically recording the dissolved oxygen and the free cyanide in the process stream.

The polarographic method, which depends on a measurement of current, lends itself to continuous recording; considerable effort has therefore been put into the problem of determining cyanide by this method in the presence of the many other substances found in cyanide plant solutions. The polarographic method also is one of the few which will determine the instantaneous or equilibrium amounts of free cyanide in the presence of complex cyanides. A procedure for the batchwise determination of dissolved oxygen which has marked advantages over other methods has also been devised. Both methods will shortly be given a trial in a small pilot plant erected at the Kalgoorlie School of Mines with the assistance of the C.S.I.R.O. and every section which is housed there.

Other Investigations

A project involving development of a suitable process for recovery of germanium from domestic sources has been completed. Certain selected power-station flue dusts of germanium content ranging from 4 to 8 oz. per ton can be treated by the new process. Should local production be required, amounts up to 0.5 tons per annum of metal, currently valued at £4 an ounce, would be available.

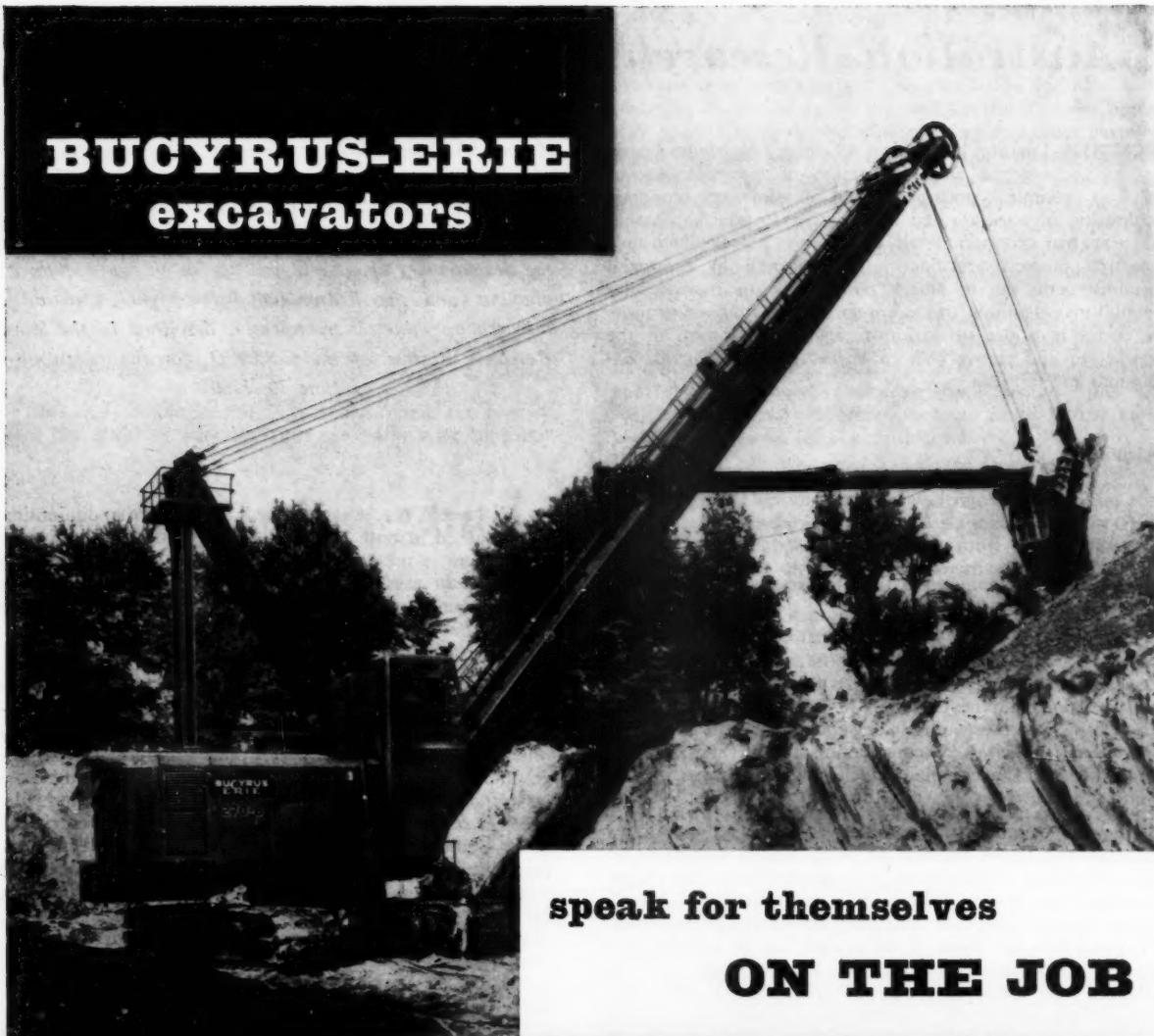
Fundamental work on the decomposition of zircon has led to pilot-plant tests of a continuous treatment of the sand in a rotary kiln; current investigations are aimed at the production of low-cost zirconium chemicals from the kiln product. Part of this programme is concerned with the significance of zirconium polymerisation in aqueous solution.

A study of the lower halides of zirconium and hafnium has been continued with a view to providing fundamental data for developments in zirconium technology.

Developments in technology and metallurgy continue to emphasise the need for supply of metals in a high state of purity. Preliminary work has therefore been done to extend the carbide-iodide process, initially developed by the Division for the supply of high purity thorium, to the preparation of other pure metals.

Other subjects on which investigations are currently proceeding include electrode processes, gas diffusion cells, reactions in electromagnetic fields, and chemical crystallography.

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Underground Dust Control and Research - I

IN terms of the Mines and Works Regulations, one or more persons must be appointed at a metalliferous mine with an underground complement of 1,000 or more per shift (and in certain cases less than that number) whose duties include the dust sampling of the mine, in order to see that the underground conditions laid down in the regulations are maintained. The mines themselves, therefore, are mainly responsible for routine dust control, and the konimeter is accepted as a suitable instrument for this control. Every working place must be sampled at least once every three months and records must be kept of the dust counts obtained.

Although no figure is actually laid down in the regulations, it is generally accepted that the average dust count as determined by the konimeter, after ignition and acid treatment, should be kept wherever possible to below 200 particles per cc., the sample being counted with dark-field illumination at a magnification of 150.

Most of the research going on concerning the problems associated with dust, centres round two main groups — the Dust and Ventilation Research Laboratory of the Chamber of Mines and the Pneumoconiosis Research Unit. A certain amount of dust research is also carried out by the Department of Mines and by the individual mines or Groups.

Some of the recent developments in dust control and the increased use of known methods will, however, be discussed briefly.

Ventilation

The total amount of air used to ventilate the mines continues to increase, as does the average amount per mine. In 1952 (I.L.O. conference), the average volume per mine during the main eight-hour shift was 454,000 c.f.m. at a density of 0.075 lb./cu. ft., whereas in 1959 it was 583,000 c.f.m. However, over this same period (1952-1959), the air per person has shown no definite trend, averaging 130 c.f.m. (the number of persons is the maximum underground at any one time), and the air per ton of rock mined per month has changed only slightly, from 4.4 to 4.5 c.f.m., indicating that the increase in ventilation is approximately keeping pace with the general increase in mining activity.

As more and more air is required for hot and deep mines the value of the research carried out into the streamlining of shaft equipment is becoming apparent. The frictional resistance of some of the older shafts could have been reduced by 60 per cent or more if the results of recent experiments had been known earlier. Certain of the old shafts have already been changed in accordance with modern streamlined or semi-streamlined design, particularly of shaft buntons. The application to a modern mine is described by Lambrechts in his paper on Western Deep levels.

The article appearing herewith is condensed from a paper presented at The Seventh Commonwealth Mining and Metallurgical Congress convened in Southern Africa. It is one of a series in which papers of particular interest are offered in abridged form

Apart from the fact that more air is being used to ventilate the mines, some improvement has taken place in certain mines concerning the better use of that air for dust control purposes. Where the longwall method of stoping can be used, for example, stope velocities of several hundred feet per minute are easily obtainable, with consequent reduction in the dust hazard from drilling and other operations taking place in that air current. Even if the volume remains unchanged these higher velocities are of incalculable value in speeding up the dispersal of dust from its source and preventing the build-up of localized areas of high dust concentrations.

Nevertheless, the general picture of ventilation in stopes and in development ends has not changed much in recent years. The table gives the average figures for stope velocities and development end volumes obtained from all mines since 1955 by the Chamber of Mines.

Year	Average face velocity in stopes (f.p.m.)	Average volume blown into development ends (c.f.m.)
1955	116	3,750
1956	113	3,460
1957	86	3,280
1958	120	4,150
1959	116	3,940

Dust Suppression

The most important change which has taken place in recent years has been the adoption of the so-called "sealed spline" machine for drilling. In this machine the possibility of compressed air leaking past the piston and atomizing the water is considerably reduced. Controlled tests comparing this type of machine with that normally used underground showed average reductions in particle count (after ignition only) of about 75 per cent, the difference being due mainly to the smaller amount of water atomized by the sealed spline machine. The adoption of this modification has, therefore, reduced very considerably the potential hazard arising from the use of water containing mineral particles in suspension. The tests showed also a smaller but still significant decrease in the dust counts after they had been treated with acid to remove water soluble material. A further step towards the elimination as a potential dust hazard of the water used in mining has been the increasing use of the nephelometer, an instrument for assessing the suspended matter in mine water photo-electrically.

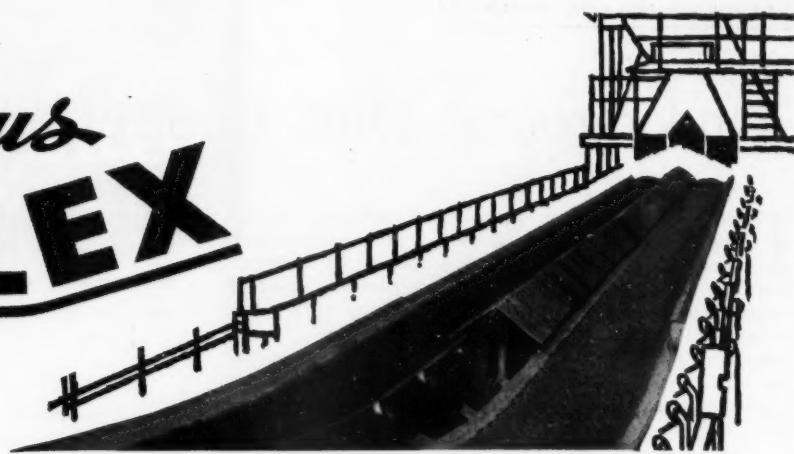
Water is the most important single factor in dust suppression methods, but its use has to be limited when air temperatures are high, with the result that the tendency today is more and more towards drier intake shafts and airways. The water used in these airways for dust suppression must, therefore, be limited or else other means must be found for suppressing the dust. The use of calcium chloride for controlling footwall dust is well known, but it is not used to a great extent in this country except in one mine, where it has been very successful. The main alternative is to keep the airways clean by washing

by

P. H. Kitto

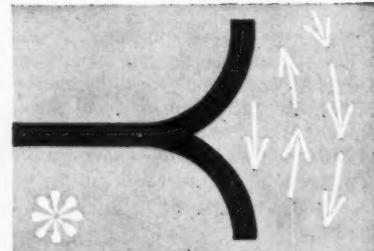
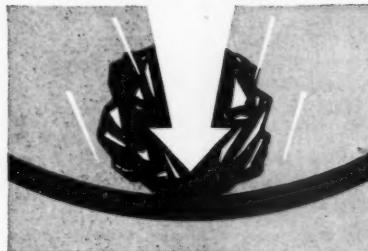
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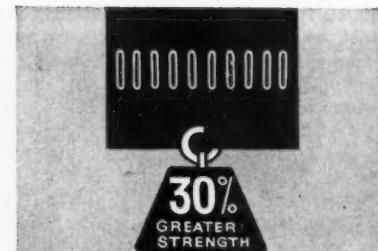
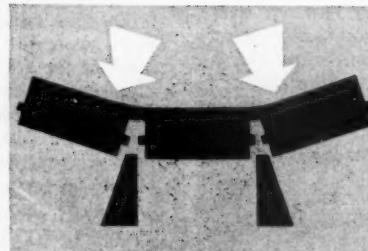
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GAFLEX has nylon weft for extra strength and flexibility

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down when necessary during the off-shift period. Concrete or bitumen-based footwalls are usually used in dry airways.

The overall picture regarding dust conditions, as reflected by the routine konimeter samples taken by mines, has shown very little change over the last ten years. Nevertheless, as they represent mineral particles counted over a range slightly wider than the 5 to 0.5 microns recommended by the National Coal Board of Great Britain, they are surprisingly low. The figures are given in the table.

Average konimeter counts in particles per cc. in certain working places underground

Year	Development ends	Stopes	Shaft sinking	Orebins, tips and loading boxes
1959	162	166	182	149
1958	170	182	186	156
1957	181	176	257	155
1956	174	176	233	161
1955	177	175	177	166
1954	174	175	181	168
1953	176	176	181	164
1952	174	184	178	162
1951	177	178	201	168
1950	177	181	212	167

No new methods of dust filtration have been adopted in the last few years, but use of the established methods of filtration has been extended.

In 1959 there were 792 dust extraction plants in use underground in the 59 gold mines, members of the Chamber of Mines. They filtered almost 6,000,000 cu. ft. of air per minute, of which 4,000,000 was filtered by flannel bags of one type or other, some of them of the automatic cleaning type. In 1954 there were 727 dust extraction plants in use, filtering almost 5,000,000 cu. ft. of air per minute.

Mining Methods

Apart from improvements in the amount of air used in certain working places and higher velocities achieved by, for example, longwall stoping, it is unfortunately true that most of the improvements in mining methods tend to increase the amount of dust produced in unit time, though not necessarily the amount per ton of rock broken.

Increased use is being made in the mines of mechanical loaders and scrapers. This dust is largely controlled by the use of water and ventilation. The total number of these rock-moving machines in use is now almost the same as the number of rock drills in use at any one time, approximately 11,000 in each case, which means that increasing attention has had to be paid to dust from this source.

There is another potential hazard, from the dust point of view, in a comparatively modern development in mining, and that is the high-speed development and multi-shift blasting technique which is practised to such a large extent today.

Research on Underground Dust

The research being carried out concerning dust control and dust suppression underground is both fundamental and operational. Fundamental work into such aspects as the properties and composition of dust, its clinical and pathological effects and statistical analyses of exposure-response records is being undertaken by the Chamber of Mines Laboratories and the Pneumoconiosis Research Unit either singly or in collaboration, and the operational work is mainly in the hands of a Rand Mines team, working under contract to the Pneumoconiosis Research Unit, and the Chamber of Mines. Assisting the Chamber of Mines from time to time and sometimes working on their own are a number of officials from

the other mines and Groups. The development, when necessary, of instruments for the measurement and assessment of dust has mostly been carried out at the Chamber of Mines Dust and Ventilation Laboratory.

From the point of view of the scientist concerned with dust research the question of what to measure is even more complicated, if accurate results are to be obtained. Apart from parameter and size, what portion of the dust cloud are we to measure? Assuming we can develop the means to do it, should we measure the quartz content only, the dust from the rock, the total dust, or each constituent separately?

The konimeter is still used in South African gold mines for routine control work. For special work the thermal precipitator in one form or another has been in constant use since 1935. The modified thermal precipitator takes 10 separate samples on a 3 x 1 in. slide, whereas the long-sampling thermal precipitator gives a continuous record of the dust on a moving slide for any period up to 24 hours. In each case aspiration is carried out by means of a small diaphragm pump and the entrance channel is designed to exclude the larger particles in a manner resembling the lung-retention curve. The standard thermal precipitator head is also used for certain types of work, including samples for electron microscope examination.

It has become evident that for dust research underground, and for purposes of dust control, visual microscope methods of assessing the dust are inadequate to cope with the number of samples which should be taken and could be taken even with the dust sampling instruments at present in use. For that reason a photoelectric method of assessment is being used, in spite of its known limitations, for much of the operational research sampling which has been and is being done, and it is hoped that in time this or some other rapid means of assessment will be used for dust control purposes as well. If a more frequent check could be made of all working places, preferably by instruments working automatically, and the samples could be rapidly assessed, not only would the psychological effect on the workers help to prevent dust conditions from deteriorating, but also the occasional increases in dust due to unforeseen circumstances could be more rapidly detected and attended to.

The capabilities and possibilities of an automatic particle counter are also being investigated, and there is, of course, a wide field of research for other methods of rapidly measuring the dust samples that have been collected by one means or another. Assessment *in situ* is not favoured in these mines because the amount of rock dust present in the air is not large compared to possible contaminants such as water droplets, smoke, atmospheric pollution and so on. These are easier to remove by laboratory treatment than underground.

The electron microscope has given us much information concerning the numbers of sub-microscopic particles present in mine air and concerning the true sizes of the small particles as measured normally with the optical microscope. Efforts are now being concentrated on finding out more about the composition of these sub-microscopic particles, as it is evident that a large percentage of them are not derived from the rock, and there is some doubt as to whether there are enough quartz particles present below, say, 0.1 microns, to constitute a health hazard.

To obtain the quartz content of the airborne dust underground, samples are usually collected by electrostatic precipitation, using portable precipitators, and analysed by X-ray diffraction. As would be expected, a wide variation in quartz content is obtained, but after ignition and acid-treatment of the samples the amount of quartz is usually between 30 and 70 per cent. Information on how this percentage varies with particle size is incomplete and the problem is being investigated. The main difficulty is the absolute measurement of the quartz content of dusts below about half a micron in size, as X-ray results in this region are somewhat doubtful. Efforts are being made to determine the accuracy of the analysis of these fine particles.

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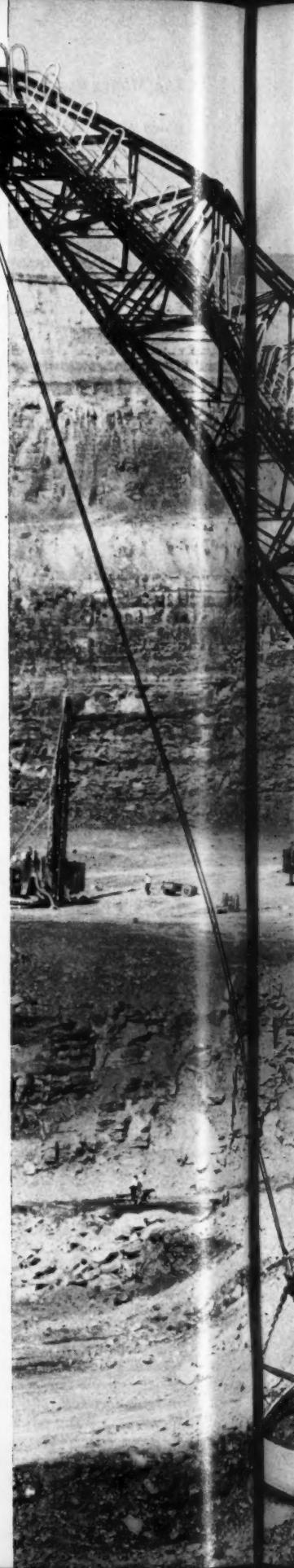
RAPIER-built for faster mining of South Wales anthracite

This mammoth Rapier W.1800 walking dragline, now digging, lifting and dumping 60 tons of rock and earth a minute at the Glyn Neath workings of the National Coal Board, weighs 1800 tons and operates a 40 cu. yd. bucket from its 247-ft. boom. It is being used by contractors George Wimpey, stripping over-burden to expose beds of high quality anthracite 300 ft. below the surface.

The machine was designed and built by Ransomes & Rapier, backed by the great engineering resources of the Newton Chambers Group of Companies. They are the only British organisation among the three or four in the world who produce excavating machinery of this size. Rapier walking draglines are at work from Australia to Scandinavia, from Africa to North America.

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Machinery and Equipment

ELECTRICAL ROCK BREAKING

We may expect to hear more about hydroelectric rock breaking. Tests in the United States and Russia have demonstrated that high-voltage sparks under water can have an astounding shattering effect on rock, but perhaps at a rather low efficiency.

★

A method of breaking rocks electrically has been successfully tested by the Montana School of Mines and Westinghouse Electric Corp.

The single step employed in breaking rocks electrically contrasts with the conventional methods involving drilling and the use of explosives and is applicable to secondary blasting. It is claimed that the electrical approach is safer because the rock gradually crumbles instead of disintegrating violently as it does under the impact of explosives.

Joint experiments were carried out recently at the industrial electronics laboratories of Westinghouse in Baltimore, following preliminary tests made at the electrical laboratories of the Montana School of Mines. The equipment used consisted primarily of a radio-frequency generator similar to a small but powerful radio transmitter. Instead of sending out its power through the usual antenna, the power of the generator is directed through wires to a rock.

The concentrated high frequency current heats a path through the rock which expands more than the unheated areas. This differential expansion causes the rock to crumble. The presence of small amounts of water in rocks is said to assist in this process.

OPENING UP THE ARCTIC

A. V. Roe Canada, plans the Avro Big Wheel, a large overland vehicle designed to beat the immense costs of building a road and rail complex through the hundreds of miles of Canada's rugged and so far inaccessible Northern Arctic regions.

The Big Wheel would be so large it could ignore both distances and the kind of terrain over which it might travel. Its main functions could include massive earth-moving, assistance in the construction of industrial sites and the building of new Arctic harbours.

Below, the Fiat FL8 tractor shovel by Mackay of Feltham

The Big Wheel's proposed dimensions are immense. It will have a gross weight of over 1,000,000 lb., a 300,000 lb. payload, and tyres weighing a total of 320,000 lb. The Big Wheel will be able at one time not only to store hundreds of feet of steel coil, but the machinery to make it into steel pipe and then lay it under the tough terrain.

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Avro's leaders claim that with the prohibitive costs of building a Canadian Arctic land transport system, estimated at between \$800,000,000 and \$1,000,000,000 the cost of several, self-contained Big Wheels, with their immense work capacity, would be cheap by comparison.

ALUMINIUM MINE CARS

Aluminium mine cars have moved up to production status. Irwin-Sensenich Corp. has announced that it has started production of two lots, totalling 125 units, of the light metal coal carriers, for use by a major U.S. coal producer. The cars will be constructed of aluminium plate and extrusions supplied by Aluminum Co. of America.

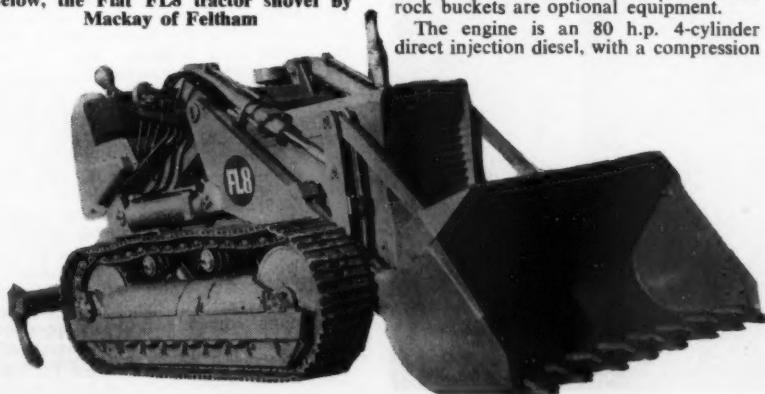
Due to equipment variations at the mines, the first shipment of 85 cars will feature cast aluminium bumpers, while the remaining 40 units will have automatic couplers.

The aluminium coal carriers—limited by mining requirements to a specific size—weigh about three tons compared to five tons and up for steel cars. The higher payload-to-weight ratio permits mine locomotives to move more cars in a train.

NEW TRACTOR SHOVEL

The new Fiat FL8 tractor shovel, an 80 h.p. machine, is a newcomer to the earthmoving field. In performance the machine shows excellent manoeuvrability and speed of operation. The rated bucket capacity of 1½ cu. yd. is not high in relation to the horsepower, but the speed of digging lift and runback are claimed as remarkable. Oversize and rock buckets are optional equipment.

The engine is an 80 h.p. 4-cylinder direct injection diesel, with a compression



ratio of 15 to 1, the bore and stroke being 125 mm. and 140 mm. The governed speed is 1650 r.p.m. which is moderate and should ensure long life. The 24 volt electric starting and lighting are standard.

Bucket capacity (S.A.E. rating), is 1.5 cu. yd., bucket width is 79 in., angle of discharge at maximum lift is 66 deg., height of discharge (bucket at 45 deg.) is 8 ft. 2½ in., bucket reach at maximum discharge height is 2 ft. 11½ in., and digging depth is 9½ in.

★

The Department of Mines of Quebec reports a versatile centrifugal separator for separating light-weight particles of asbestos, sand, etc., from heavier particles with which they are mixed. The separator will select any given particle size or weight by adjusting the velocity and angle of the jet entry. It consists of two concentric metal containers interconnected by ports arranged spirally. Material to be separated is blown into the space between two cylinders; the lighter particles flow into the central chamber, the heavier particles continue to the far end and to a separate chamber.

★

D. A. Dahlstrom of the Eimco Corporation reports that the use of endless belt vacuum filters has increased greatly during the past year; in most cases they have either eliminated a severe blinding problem or increased recovery of soluble values by improved washing of the filter cake. The cloth is made endless by use of a zipper so that one man can change a cloth on a large filter in one-half hour, as compared with two men for eight hours to change cloth on a conventional filter.

★

An interesting portable oxygen meter has been developed at the Mines Branch, Department of Mines and Technical Surveys, Ottawa, for measuring the amount of dissolved oxygen in gold and uranium pulps. Since it has been found that the diffusion current is proportional to the amount of dissolved oxygen, when two suitable electrodes are immersed in the solution under test, this current can be used to measure the amount of oxygen present. A sample of solution for test is fully aerated by passing air through it and after it is saturated rapid readings are made in succession of the diffusion current which will pass through the untreated sample and the saturated one. The ratio of the two diffusion currents when multiplied by 100 represent numerically the percentage of air saturation in the sample. Since its development the oxygen meter has been used in field trials in some gold mills in the Porcupine area.

★

In order to meet the increasing demand for superior grade coking coal for the U.K. iron and steel industry and in view of the number of small collieries, central washeries are being planned. It may then be necessary to provide different washing circuits for different classes of coal, or in some cases to blend the feed. In general heavy media is used for a size range 3 in. to 1 in., 3 in. to ½ in. or 3 in. to ¼ in., depending on the washing characteristics, using Baum jigs, Felspar jigs or cyclone washers on the fines. It is also often necessary to wash the heavy media feed in Baum jigs to remove obvious dirt so that a consistent feed is obtained. This is most important when supplies are drawn from a number of small sources producing coals of indifferent quality and consistency.

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Aluminium mine cars have moved up to production status. Irwin-Sensenich Corp. has announced that it has started production of two lots, totalling 125 units, of the light metal coal carriers, for use by a major U.S. coal producer. The cars will be constructed of aluminium plate and extrusions supplied by Aluminum Co. of America.

Due to equipment variations at the mines, the first shipment of 85 cars will feature cast aluminium bumpers, while the remaining 40 units will have automatic couplers.

The aluminium coal carriers—limited by mining requirements to a specific size—weigh about three tons compared to five tons and up for steel cars. The higher payload-to-weight ratio permits mine locomotives to move more cars in a train.

NEW TRACTOR SHOVEL

The new Fiat FL8 tractor shovel, an 80 h.p. machine, is a newcomer to the earthmoving field. In performance the machine shows excellent manoeuvrability and speed of operation. The rated bucket capacity of 1½ cu. yd. is not high in relation to the horsepower, but the speed of digging lift and runback are claimed as remarkable. Oversize and rock buckets are optional equipment.

The engine is an 80 h.p. 4-cylinder direct injection diesel, with a compression

ratio of 15 to 1, the bore and stroke being 125 mm. and 140 mm. The governed speed is 1650 r.p.m. which is moderate and should ensure long life. The 24 volt electric starting and lighting are standard.

Bucket capacity (S.A.E. rating), is 1.5 cu. yd., bucket width is 79 in., angle of discharge at maximum lift is 66 deg., height of discharge (bucket at 45 deg.) is 8 ft. 2½ in., bucket reach at maximum discharge height is 2 ft. 11½ in., and digging depth is 9½ in.

★

The Department of Mines of Quebec reports a versatile centrifugal separator for separating light-weight particles of asbestos, sand, etc., from heavier particles with which they are mixed. The separator will select any given particle size or weight by adjusting the velocity and angle of the jet entry. It consists of two concentric metal containers interconnected by ports arranged spirally. Material to be separated is blown into the space between two cylinders; the lighter particles flow into the central chamber, the heavier particles continue to the far end and to a separate chamber.

★

D. A. Dahlstrom of the Eimco Corporation reports that the use of endless belt vacuum filters has increased greatly during the past year; in most cases they have either eliminated a severe blinding problem or increased recovery of soluble values by improved washing of the filter cake. The cloth is made endless by use of a zipper so that one man can change a cloth on a large filter in one-half hour, as compared with two men for eight hours to change cloth on a conventional filter.

★

An interesting portable oxygen meter has been developed at the Mines Branch, Department of Mines and Technical Surveys, Ottawa, for measuring the amount of dissolved oxygen in gold and uranium pulps. Since it has been found that the diffusion current is proportional to the amount of dissolved oxygen, when two suitable electrodes are immersed in the solution under test, this current can be used to measure the amount of oxygen present. A sample of solution for test is fully aerated by passing air through it and after it is saturated rapid readings are made in succession of the diffusion current which will pass through the untreated sample and the saturated one. The ratio of the two diffusion currents when multiplied by 100 represent numerically the percentage of air saturation in the sample. Since its development the oxygen meter has been used in field trials in some gold mills in the Porcupine area.

★

In order to meet the increasing demand for superior grade coking coal for the U.K. iron and steel industry and in view of the number of small collieries, central washeries are being planned. It may then be necessary to provide different washing circuits for different classes of coal, or in some cases to blend the feed. In general heavy media is used for a size range 3 in. to 1 in., 3 in. to ½ in. or 3 in. to ¼ in., depending on the washing characteristics, using Baum jigs, Felspar jigs or cyclone washers on the fines. It is also often necessary to wash the heavy media feed in Baum jigs to remove obvious dirt so that a consistent feed is obtained. This is most important when supplies are drawn from a number of small sources producing coals of indifferent quality and consistency.

MINING MISCELLANY

The construction of four collieries will be continued in the Rybnik fields during Poland's current Five Year Plan. The Rybnik fields are estimated to contain reserves totalling 3,500,000,000 tonnes, and a sum of 13,400,000,000 zloties has been invested in the area for the 1961-1965 period. *

Interest is reported in copper leases in the Cloncurry district of North Queensland. This region contains numerous copper deposits discovered in the early years of mining activity, and was the scene of much active work in those years, ultimately killed by inadequate transport, droughts, and water shortage, as well as recurrent labour troubles, collectively leading to the abandonment of mines of potential promise. Rio Tinto Co. is reported to have made a substantial offer for a copper lease believed to be the Trekalano Mine, one of the most promising properties in the area. Other once promising names are Hampden Cloncurry, Mount Cuthbert and Mount Elliott. With railway communication to the field, and the reduction in freight costs from the ruinous charges of the early years, the outlook for mines of reasonable promise could well be changed.

Spare-parts storage racking manufactured by Dexion Ltd. in the underground maintenance depot of a mine in the Moselle region of France. Built in Dexion slotted angle and chip-board, these racks were made-to-measure on the spot. Packets of Dexion can be taken underground and used by unskilled labour to build all kinds of storage installations



Aluminium Ltd. of Canada is building a plant at Sungai Ringgit, near Ramunia, Johore, for washing ore mined by its Malayan subsidiary Southeast Asia Bauxites Ltd. The plant, scheduled to be completed in April 1962, is designed for an annual throughput of 500,000 tons. Southeast Asia Bauxites has established an associate company, Johore Mining and Stevedoring Co. Ltd., to operate the new plant. A statement by Alcan says that since Southeast Asia Bauxites started mining bauxite in Johore in 1939 the demand for the ore has increased tremendously. The new plant is being installed because of the expanding requirements of Nippon Light Metal Co. Ltd. of Japan, a minor shareholder in, and the principal customer of, Southeast Asia Bauxites. *

Copper reserves have been located "relatively near the surface" at Gaisk, near the Russian town of Mednogorsk. The reserves have a Cu content of some 23.7 per cent maximum. It is planned to erect a copper refinery and mine complex there in the near future. In comparison with these reserves properties, it is stated that average metal content of Ural copper ores is no more than 2.5 per cent.

Large-scale magnesite and baryte deposits have been discovered near the town of Cacak in the Yugoslav region of Serbia. The reserves are believed to contain some 1,000,000 tonnes of magnesite and 200,000 tonnes of barytes.

It has been reported from the Philippines that the Aluminium Co. of Malaya has submitted a proposal to establish an aluminium reduction plant in the islands. The scheme is said to envisage an annual output of approximately 25,000 tons.

At Weipa, dredging of the port is to be expedited by the use of a second dredge, and it is expected that the channel will be available for ocean-going cargo ships in about 18 months time. First shipments from this North Queensland bauxite deposit will probably be to Bell Bay, Tasmania.

An agreement was signed recently between the Indian National Coal Development Corporation and the Polish firm, CEKOP, for the development of deep-shaft mine project at Sudamdh in Jharia, in Bihar. According to the agreement, the Polish firm will prepare a project report for a colliery in Jharia consisting of two mines—a deep-shaft mine and an incline—with a common surface plant. The surface equipment will include a coal washing plant besides workshop, coal bunkers, etc. The planned output of raw coal from the mines is 7,500 tons per day. The underground mine is situated 12 miles from Dhanbad railway station and nearly 3 miles from Patherdh railway station with an area of 1.75 miles along the strike and nearly 1 mile along the dip. The area consists of 14 coal seams of varying thickness of 4 to 60 feet with a total reserve of nearly 250,000,000 tons and with an ash content of 10 to 28 per cent.

According to recent reports, production at the Kiruna iron ore mine in Northern Sweden is increasing more rapidly than has been expected, and it is likely that output figures in the next few years will be exceptional. Speaking to local authorities in Kiruna recently Mr. Arne Lundberg, managing director, L.K.A.B. group, said that present indications were that current output, now running at about 13,000,000 tons annually would reach 15,000,000 tons by 1965 and 18,000,000 tons by 1968 when the new development at Svappavaara came into full operation. Mr. Lundberg also mentioned the Haukivaara strike just north of the centre of the Kiruna mine. This had come as a surprise. The iron ore was blood-stone containing high percentages of iron and phosphorus. The deposits seem to be between 200 and 300 m. in length and 50 m. wide, but at the moment depth cannot be established.

There is speculation that future Russian aluminium may be produced from nepheline. Huge deposits of this material occur around Murmansk in Russia's Arctic region and are said to be the richest in the world. Russian aluminium currently is being produced from Hungarian bauxite which reportedly has reserves of 120,000,000 tons—140,000,000 tons.

Intensive geological surveys, conducted jointly by the U.S.S.R. and China for some years past in the Amur Basin, lying on their common border in the Far East, have resulted in discoveries which justify expectation that an important industrial complex may be established there. Many of the deposits are located in populated areas, with well-developed transport facilities, and many of them lend themselves to cheap extraction by opencast mining. According to the head of the Soviet Far Eastern Geological Board, Mr. Victor Ermolyuk, they provide the requisite foundation for the establishment of a Far Eastern iron and steel base, for which purpose further advantage would derive if indications of the presence of oil and natural gas in commercial quantities are confirmed.

★

A newly compiled Soviet geological map of the Arctic and sub-Arctic is being distributed to the scientific organizations of the U.S.A., Canada, Denmark and other countries whose experts have collaborated in its preparations. Drawn under the direction of Dr. Eydor Markov, of the Leningrad Arctic Institute of Geology, it gives a general idea of the geological structure and of the history of the development of the earth's crust in the area north of the 58th parallel. It is of more than academic interest, moreover, for it provides the scientific basis for new prospecting for minerals in the Polar regions of Europe, Asia and America. It covers not only the Soviet Arctic, but also that of Scandinavia, Greenland and America, including the Arctic islands and Archipelagoes. The map is being published by the State Publishers of Geological Technological Literature in Moscow.

★

The erection in Ghana of a ferromanganese plant is stated to have been among a number of projects covered by the recent signing of agreements between the Ghanaian government and a number of Russian trading organizations.

★

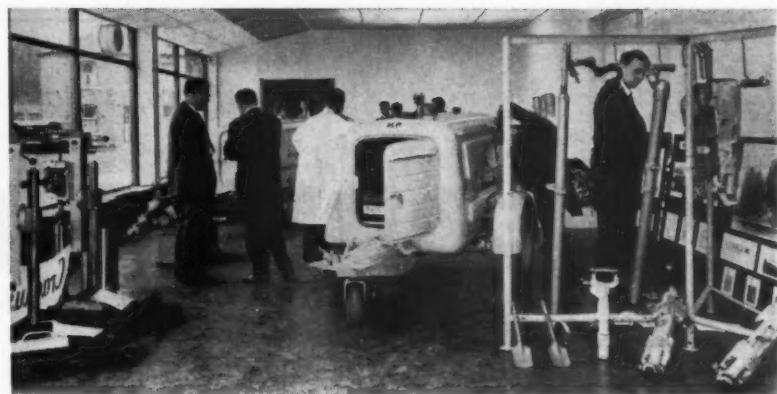
The contract for the winding installation of the new K 57 shaft of Mount Isa Mines Ltd. has been awarded to ASEA Electric (Aust.) Pty. Ltd., Queensland. The £1,500,000 contract includes a 200 ft. tower containing all the machinery for three hoists of 12,800, 6,400 and 700 h.p. The first, for the main skip hoist, is designed to raise 800 tons of ore an hour from an ultimate depth of 4,000 ft. The second, the cage hoist, can carry a 20 ton loco or 160 men. The last is an auxiliary hoist. Site erection begins in September next year, and the whole project is to be completed and in service by May 1964.

★

John L. Kimberly, executive vice-president of the American Zinc Institute, forecast that total usage of zinc by the motor car industry in 1962 model production would rise by at least 10 per cent. The increase resulted from greater use of zinc in the form of die castings and galvanized sheets in both standard and compact size models.

★

It is reported from Plovdiv, Bulgaria, that the new lead-zinc plant which is now in process of erection there is to be fully mechanized throughout its 9 processes, the required equipment being supplied by the U.S.S.R.



An unusual exhibition was held at the Durham Road, Birtley, Co. Durham, premises of Marsh Plant Services Ltd. from September 26 to 29, when this company devoted the whole of its indoor and outdoor show space to a display of the products of one of the manufacturers for whom they act as agents. The manufacturer in question was Atlas Copco (Great Britain) Ltd. and the items on view ranged from mine loaders to small pneumatic tools. In the picture visitors are seen examining an Atlas Copco VT4 portable air compressor (centre) which has an air delivery of 140 c.f.m. at 100 p.s.i. On the right is a selection of rock drills, breakers, etc., complete with attachments. In the background (left) is the Cobra self-driven breaker/drill complete with its box, and behind it a larger machine in the portable compressor range, the VT5. Capacity: 220 c.f.m. at 100 p.s.i.

Plans for building an atomic research facility at Albany, Oregon, for studying minerals and mineral fuels were recently announced by the U.S. Bureau of Mines. The new structure, scheduled for completion within the next 12 months at the Bureau's Metallurgy Research Centre, will house 100,000 curies of cobalt-60 to be supplied by the Atomic Energy Commission. This radioactive isotope will be used in fundamental research to determine the effects of gamma radiation on the physical and chemical properties of coal, petroleum, and many metallic and non-metallic minerals. Gamma irradiation is expected to help advance mineral technology, either by altering the properties of minerals and fuels so they can be processed more easily or by actually speeding chemical reactions in mineral-treating process. Small-scale studies by the Bureau of Mines already have indicated that both approaches are promising.

★

The formation of the European Lead Development Committee has been announced following meetings in Rome of representatives of the French, German, Italian, Spanish and U.K. lead development associations, and Belgian and Swedish lead producers. The U.K. Lead Development Association will be responsible for the secretarial work of the new committee under guidance of a steering group from various European nations.

★

Dr. Michael Klugman, assistant professor of geology at the Colorado School of Mines, has been awarded a \$27,000 National Science Foundation Grant for ore deposits trace elements research. By correlating trace elements—non-ore elements which form a halo round deposits—Dr. Klugman hopes to determine specific patterns for particular ores. This project, if successful, could lead to the creation of a new exploration tool for locating ore deposits.

★

Venezuela's iron ore production during the period January-July of this year was 9,160,000 tons against 11,300,000 tons, a decrease of 19 per cent.

Keynote speaker at the Annual Convention of the Magnesium Association to be held in New York from October 16-18 will be Major C. J. P. Ball, chairman of Magnesium Elektron Ltd., of Britain. Major Ball's address will underline the theme of the meeting, "Magnesium in Focus", and is expected to outline the industry's progress and possibilities for the future.

★

Two U.S. companies, Homestake Mining Co. and U.S. Borax and Chemical Corp., have entered into a joint venture to complete studies relating to possible large scale potash production in Saskatchewan, Canada, where the latter company has been investigating an area held under permit since 1957. U.S. Borax is America's second largest producer of potash, while Homestake Mining has had extensive experience in gold and uranium mining. If the completed studies indicate that the operation under investigation is technically and economically feasible, the two concerns may participate equally in any company formed for the purpose.

★

An announcement by the Toho Zinc Co. states that seven Japanese smelters have succeeded in acquiring 10,000 tons of lead bullion through an international tender recently held in London by Consolidated Zinc. This bullion, it was stated, would be produced at the Cockle Creek smelter in Australia starting in October and would contain 99.5 per cent lead as well as a small percentage of silver. The announcement added that the smelters had not been too successful in securing imports of lead ore and so had turned to lead bullion.

★

The Council for Scientific and Industrial Research has decided to discontinue the publication of *Technical Digests*. The September issue was the last to be circulated, and unexpired portions of subscriptions will be refunded as soon as possible.

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Metals and Minerals

No Aluminium Price Cut Yet for Europe

This week hopes for cheaper aluminium in Europe which had been rising for several weeks in some industrial quarters faded when Aluminium Ltd. issued a denial that the company was planning to reduce its European export price of the metal. Since the war European prices for primary aluminium have been virtually determined by the export prices fixed by the Canadian producer, although at times they have been under pressure when Russian supplies have come on to the market.

Rumours of a pending price cut began to circulate when Alcoa, the leading American producer, announced a price reduction of 2 cents a lb. on September 25 which was quickly followed by similar reductions by Reynolds and all other U.S. primary producers (see *The Mining Journal*, September 29, 1961). However, in the absence of any direct relationship between the U.S. domestic price of aluminium ingot and prices on this side of the Atlantic there was no real foundation for expectations of this sort. The U.S. aluminium industry because of its structure and the protection afforded by an import duty of 1½ cents a lb. produces for an isolated market.

The U.S. price cuts were in fact a counter move to sharper competition from Alcan in the North American market. Thus Alcoa's initial price reduction was prompted by the option given to United States fabricators by Alcan last month to buy Canadian metal at 23½ Canadian cents a lb. provided they bore the cost of transport and the U.S. import duty. The general line up of U.S. pro-

ducers was clearly aimed at preventing any major increase in U.S. imports of Canadian metal. Of course, the U.S. price cuts could also reflect in part a change in policy but it seems most unlikely that there is yet going to be any radical move from the U.S. traditional maintenance of artificial commodity price levels. Three times in the past five years the U.S. domestic price of aluminium ingot has been increased in the summer in line with simultaneous wage increases under long-term labour contracts, despite the fact that they ran contrary to the trend of demand and were out of step with the rest of the world.

European aluminium circles directly concerned by a change in the basic price, and therefore better informed about the general background, appreciated from the outset that there was little if any connection between developments in the U.S. and the market outside.

Even at 24 cents a lb. the U.S. market is still above most other parts of the world where the price is 23½ cents a lb. c.i.f. in U.S. not Canadian currency. It is certainly above the U.K. price of £186 per ton delivered to consumers works.

The Aluminum Company of America has announced a reduction of two dollars per lb. in calcined alumina A-2 to 98 dollars per lb. in carload lots, effective immediately. Alumina is used in a large volume by manufacturers of abrasives, refractories and ceramics. A company source said the reduction should en-

courage a greater use of alumina A-2 in the high alumina ceramic fields.

Austria's aluminium output in the first six months of this year amounted to 46,209 tons against 44,545 tons in the corresponding period of 1960.

ABBEY AND MARGAM STEEL PLANT CLOSES

The Abbey and Margam works of the Steel Co. of Wales, which employs 17,000 men and produces 60,000 tons of steel a week, was closed yesterday because of a labour dispute concerning fitting and maintenance.

The setback adds yet another worry to the industry which is running nearly one-quarter below full capacity, mainly because customers are unwilling to go on holding large stocks. In overseas markets, while deliveries are being maintained, competition is growing, prices are falling and so are new orders.

Reduced demand for iron ore from European countries, and Britain in particular, has resulted in a decline in Spanish exports according to *El Economista*. Even West Germany, a good customer for Spanish iron ore, has been buying less this year, but it is thought that German demand will revive when Nordic ports become seasonally closed to Swedish ores.

COLUMBIUM ZIRCONIUM WIRES

A report from Pittsburgh states that research workers of the Westinghouse Electric Corporation have successfully constructed a super-strength electromagnet made of superconducting columbium-zirconium wire. Weighing only about a pound and about the same size as a doughnut, the new magnet is said to create a magnetic field twice as strong that of a conventional iron-core magnet as big as a motor car and weighing 20 tons. According to Westinghouse, it carries the promise of further major breakthroughs in the fields of both electrical power and nuclear energy.

TELLURIUM IS BOOMING

Production and shipments of commercial grade tellurium rose to record levels in 1960, according to the U.S. Bureau of Mines. Production rose by about one-third to 260,000 lb. while shipments increased to 320,000 lb. Commercial grade tellurium was selling at \$4 a pound last year and last May the price was raised \$1.25 to \$5.25 a pound. High purity tellurium now sells at around \$25 a pound, its price having been raised by \$1.50 last year coincident with a higher purity content.

Increased demand for the metal has come primarily from the electronic and electrical industries, particularly in the manufacture of components for various refrigeration units. Although some consuming industries are believed to be developing new components which may use less, proportionately tellurium, demand is expanding for the metal in military and space applications; the market for the metal for new civilian devices is also fanning out.

The U.S.S. Lead Refinery, Inc. which is affiliated to the United States Smelting Refining and Mining Co. is reported to

LONDON METAL AND ORE PRICES, OCTOBER 12, 1961

METAL PRICES

Aluminium, 99.5%	£186 per ton
Antimony—	
English (99%) delivered, 10 cwt. and over	£230 per ton
Arsenic, £400 per ton	
Bismuth, (min. 1 ton lots) 16s. lb. nom.	
Cadmium 11s. 0d. lb.	
Cerium (99%) net, £15 0s. lb. delivered U.K.	
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.	
Cobalt, 12s. lb.	
Germanium, 99.99% Ge. kilo lots 2s. 5d. per gram	
Gold, 250s. 0d.	
Iridium, £20/£23 oz. nom.	
Lanthanum (98%/99%) 15s. per gram	

Magnesium, 2s. 2½d./2s. 3d. lb.
Manganese Metal (96%98%) £275/£285
Nickel, 99.5% (home trade) £660 per ton
Osmium, £17/£22 oz. nom.
Osmiridium, nom.
Palladium, Imported, £8 12s. 6d.
Platinum U.K. and Empire Refined £30 5s.
Imported £27 7s. 6d./£27 17s. 6d.

Quicksilver, £62 ex-warehouse
Rhodium, £43/£45 oz.
Ruthenium, £14/£16 oz. nom.
Selenium, 46s. 6d. per lb.
Silver, 79½d. f. oz. spot and 80½d. f.d.
Tellurium, 37s. 6d. lb.

ORES AND OXIDES

Antimony Ore (60%) basis	30s. 0d./33s. 0d. per unit c.i.f.
Beryl (min. 10 per cent BeO)	270s./275s. per l. ton unit BeO
Bismuth	65% 8s. 6d. lb. c.i.f.
Chrome Ore—	18/20% 1s. 3d. lb. c.i.f.
Rhodesia Metallurgical (semifriable 48%) (Ratio 3 : 1)	£15 5s. 0d. per ton c.i.f.
Hard Lump 45% (Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
Refractory 40% (Ratio 3 : 1)	£11 0s. 0d. per ton c.i.f.
Smalls 44% (Ratio 3 : 1)	£13 5s. 0d. per ton c.i.f.
Pakistan 48% (Ratio 3 : 1)	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10:1) $Nb_2O_5 : Ta_2O_5$	150s./160s. 0d. per l. ton c.i.f.
Lithium Ore—	
Petalite min. 34% Li_2O	50s. 0d./55s. 0d. per unit f.o.b. Beira
Lepidolite min. 31% Li_2O	76s. 0d./80s. 0d. per unit f.o.b. Beira
Amblygonite basis 7% Li_2O	75s. 0d./85s. 0d. per ton f.o.b. Beira
Magnesite, ground calcined	£28 0s./£30 0s. d/d
Magnesite Raw (ground)	£21 0s./£23 0s. d/d
Manganese Ore Indian—	
Europe (46%48%) basis 60s. 0d. freight	73d./75d. c.i.f. nom.
Manganese Ore (43%45%)	69d./71d. c.i.f. nom.
Manganese Ore (38%40%)	nom.
Molybdenite (85%) basis	10s. 0d. per lb. (f.o.b.)
Titanium Ore—	
Rutile Australian 95/97% TiO_2 (prompt delivery)	£25 10s. per ton c.i.f.
Ilmenite Malayan 50/52% TiO_2	£11 0s. per ton c.i.f.
Ilmenite Travancore 58/60% TiO_2	£15/£15 10s. per ton c.i.f.
Wolfram and Scheelite (65%)	118s. 0d./120s. 0d. per unit c.i.f.
Vanadium—	
Fused oxide 95% V_2O_5	7s. 6d./8s. per lb. V_2O_5 c.i.f.
Zircon Sand (Australian) 65-66% ZrO_2	£16/£16 10s. ton c.i.f.

have nearly completed a modern tellurium plant with a rated capacity of 60,000 lb. a year. This plant should be in full operation by the end of October next. It will consist of solution, storage and precipitating tanks, leaching equipment, filters, a dryer, electric furnace and an integrated dust and fume collection plant.

Tellurium steel is currently selling in the U.S. at \$15-\$25 more than ordinary steel. It is being claimed that steel containing even small amounts of tellurium can be machined in more than one-third less time than standard screw machine stock and speeds of more than 600 surface feet per minute have been recorded.

WOLFRAM IN THE DOLDRUMS

The wolfram ore shipment market remains in the doldrums, trade quarters say, and current price ideas now range from 118s. to 120s. per long ton unit c.i.f. Europe in comparison with 120s. to 123s. previously. It is understood that a little business has been done at the lower end of the new range but in view of the overall quietness of demand there are some doubts as to whether business could be repeated even at this level.

EXPANDING MARKETS FOR LITHIUM

Lithium is not a rare metal but because of its lightness and capacity to absorb large amounts of hydrogen its use is spreading. The main consumer of lithium hydroxide is the petroleum in-

dustry which takes about 2,000,000 lb. a year for greases. Lithium carbonate holds second position because of demand from the glass and ceramic industries. The chlorides of the metal and other halides find a variety of uses in air conditioners, brazing and welding fluxes.

New markets for lithium compounds, however, are developing in the manufacture of aluminium alloys because of the tensile and elastic characteristics it imparts to aluminium. Compared with other alkali metals and alkaline earths lithium is more electro-negative and tends to form alloys more easily.

Although up to now the price of lithium has been relatively high compared with the price of competitive sodium and potassium for a number of uses, the scale of manufacture of lithium compounds now permits mass production economies. But in any case lithium, in its metallurgical applications, in grease manufacture and as a catalyst, is often used in such relatively small quantities that price is not a prime consideration. But clearly, as large scale production of the metal gets under way, producers are looking not for an aggregate of small sales of that sort, but demand on a commensurate scale with mass production, hence their particular interest in the use of the metal alloys.

GERMANIUM CONSUMPTION RISES

Last year U.S. output and consumption of germanium rose by about 20 per cent as the result of increasing demand for the metal for rectifiers and other solid

state electronic devices. However, says the *American Metal Market*, it is problematic whether or not the rising trend will continue because of developments with other electronic metals. But if germanium loses in some areas producers are optimistic about gains elsewhere. The leading U.S. producers are sponsoring new research on germanium at the Southwest Research Institute. Generally research was accelerated throughout 1960. In particular magnetic upgrading to increase the recovery of germanium concentrate was achieved through the use of Franz Ferro filter, grown crystals were obtained by means of the iodide process, and Stations of the Bureau of Mines studied the possible recovery of germanium from coal and other materials.

Consumption last year according to the U.S. Bureau of Mines was some 54,000 lb. against 45,000 lb. Imports amounted to some 52,000 lb. including germanium dioxide mainly from Canada, Italy, Japan and S. Africa.

S. KOREAN BISMUTH PLANT

The South Korea government-owned Korean Tungsten Co. has opened a refining plant to produce bismuth ingots thus permitting the export of ingots rather than bismuth concentrates as hitherto.

Company officials said that S. Korea's bismuth export would reach 200 tons a year beginning in 1962 and earnings from the export trade would increase to \$U.S.1,000,000 from the current annual earnings of about \$U.S.750,000.

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PERUVIAN SILVER OUTPUT

Silver production in Peru in 1960 increased by 11 per cent rising from 27,200,000 oz. in 1959 to 30,300,000 oz. last year, according to figures published recently by the Corporación Nacional de Comerciantes. Peru was thus the fourth silver mining country in the Western hemisphere after Mexico, Canada and the U.S.A.

AUSTRALIAN URANIUM

A committee of enquiry has recommended to the South Australian Parliament the closure of the £45,000,000 uranium industry at Radium Hill. The committee advise the shutdown because overseas investigations have shown that there is no prospect of producing uranium profitably after the present contract has expired.

YUGOSLAV MINERAL EXPORTS

Over last year, according to current statistics issued from Belgrade, Yugoslavia exported crude magnesite worth 2,900,000 dinars (excluding sales to the Soviet zone of Germany), ground magnesite worth 17,100,000 dinars, of which 16,700,000 dinars' worth alone went to Poland, sinter magnesite worth 729,000,000 dinars, of which 387,000,000 dinars' worth went to the United States, and burnt caustic magnesite worth 238,200,000 dinars. The main customers, each with almost the same share in export worth, being Federal Germany, Holland, Poland, the Soviet zone of Germany and Czechoslovakia. Exports of ground barytes were worth 317,800,000 dinars, the United States taking 180,000,000 dinars' worth of this total, while of the 113,100,000 dinars' worth of ground barytes exported the Soviet Union bought 75,400,000 dinars' worth.

showed a fall at 19,500 tons, but total stocks of tin metal showed a very slight fall of approximately 7,600 tons as compared with the end of June, 1960. At the end of June, 1960, the buffer stock holding was 10,030 tons, whilst at the end of June this year the buffer stock holding was nil.

On Thursday the Eastern price was equivalent to £955½ per ton c.i.f. Europe.

LEAD-ZINC REMAIN STEADY

The lead and zinc markets have remained relatively unchanged, although the contango on zinc has widened considerably. Stocks of lead in official warehouses rose by 180 tons to a total of 10,809 tons, whilst stocks of zinc rose by 1,180 tons to a total of 8,377 tons. The strike at Monsanto has at last been settled with the signing of a new contract, and at the same time there has been a very much better demand for zinc by the motor industry.

Copper • Tin • Lead • Zinc

(From Our London Metal Exchange Correspondent)

Price movements have been relatively narrow during the period under review, and whilst news of the general industrial situation in the U.S. remains favourable, it is becoming increasingly apparent that business in the U.K. and Europe is not coming up to expectations and, therefore, opinion on the Metal Exchange as to the probable price trends is far from being unanimous.

COPPER IMPROVES SLIGHTLY

The world price structure for copper is if anything a little firmer, with the Belgian price now standing at 28.80 c. per lb. against 28.15 c. per lb. Antwerp or New York, the U.S. smelters' intake price for scrap being a little firmer at 25½ c. per lb. and L.M.E. stocks lower with continued support of the cash position.

The labour situation remains unchanged with strikes at Mount Isa still continuing, whilst in Chile no progress has yet been made towards new labour contracts. The market in London continues to receive support through the buying of cash metal which is responsible for a very small contango in relation to total L.M.E. stocks, although these later did fall by 2,084 tons at the end of last week.

TIN COUNCIL SPLIT ON PRICES

At the beginning of the week, the tin market gained some strength from the details of President Kennedy's reply to the Bolivian President, when the former said that the United States would not sell tin from the stockpile without consulting producer governments. He also added that in his view any releases of tin from the stockpile would be in such quantities as to tide over shortages in order to help the industry as a whole by preventing substitution.

On Thursday morning the communiqué from the I.T.C. became available and it must be said that this is one of the most disappointing communiqués which have ever been issued by that body. What was said was that the Tin Council has split in half, the producers wishing to raise the

prices to a floor price of £800 per ton and a ceiling price of £1,000 per ton. This proposal was, however, not accepted, as the majority of the consumers did not agree that this was an appropriate moment for any modification.

It is not spelt out whether the majority of consumers disagreed on the grounds that the prices themselves were wrong or whether that this was merely the wrong time to do it, and it seems that this is a very important factor which will have to be assessed by the market.

It seems that first reactions will be bearish and prices are likely to go down on selling from those people who had considered a ceiling price of £1,000 to be a certainty. In the long run, however, the communiqué must be interpreted in a bullish way as all available statistics still indicate that there is a gap between tin production and consumption; and although up to now there has been no real shortage of physical metal, there is no doubt that pipelines are getting emptier and stocks are beginning to be diminished again, and it is therefore reasonable to suppose that before the Council's next meeting in February this situation will have made itself felt and prices will probably stand considerably higher than they do today.

The half yearly statistics issued by the I.T.C. showed that in spite of all derestriction, production of mine tin in concentrates by the producer members of the I.T.C. fell to 59,100 tons as compared with 64,100 tons in the second half of 1960, and 59,700 tons in the first half of 1960. It is estimated that mine production in other countries, excluding the Eastern bloc, rose to 6,200 tons as compared with 5,400 tons in the second half of 1960.

World smelter output also showed a fall to 69,200 tons from 74,500 tons in the second half of 1960, and it is pointed out that this reduction was spread over all the main smelting countries. Against this reduction in output world consumption is given as rising to 86,700 tons against 82,300 tons in the second half of 1960. However, a large part of this can be accounted for by the consumption in Germany of metal for alloying and subsequent re-export.

Total stocks of tin in concentrates also

*
The British Bureau of Non-Ferrous Metal Statistics reports that in August the consumption of copper totalled 40,920 tons as compared with 54,556 tons in July. End of month stocks stood at 152,898 tons as compared with 142,962 tons a month earlier. Tin consumption reached 1,446 tons as compared with 1,747 tons in July and end month stocks totalled 8,350 tons as compared with 8,697 tons a month earlier. Consumption of lead totalled 24,816 tons as compared with the July figure of 28,369 tons and end of month stocks stood at 64,849 tons as compared with 63,367 tons a month earlier. Consumption of zinc totalled 21,501 tons as compared with 27,814 tons in July and end of month stocks showed an increase at 70,637 tons as compared with 65,328 tons at the end of July. These figures show that there has been a decrease in consumption during the first eight months of the year as compared with the corresponding period of 1960, in the case of copper 4 per cent, in the case of tin 6 per cent, in the case of lead 3 per cent and in the case of zinc 6 per cent.

OFFICIAL TURNOVERS

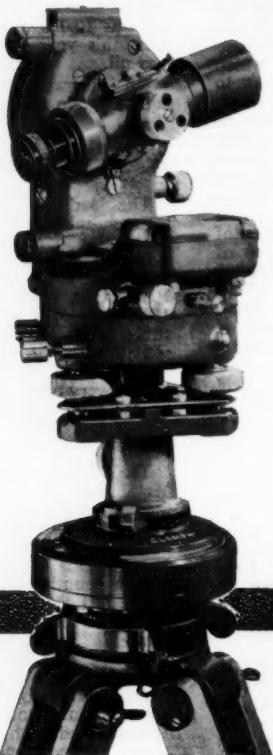
Official turnovers (in tons) for the week ending October 6, 1961, with the previous week's figures in parentheses, are:—

	October 5	October 12
	Buyers	Sellers
COPPER	...	28,450 (14,250)
Tin	...	2,830 (3,235)
Lead	...	4,550 (10,625)
Zinc	...	6,650 (5,075)

Closing prices are as follows:

	October 5	October 12
	Buyers	Sellers
COPPER		
Cash	£229	£229½
Three months	£230½	£230½
Settlement	£229½	£231
LEAD		
Current ½ month	£63	£63½
Three months	£64½	£65
Settlement	£64½	£64½
TIN		
Cash	£942	£943
Three months	£953	£954
Settlement	£943	£944
ZINC		
Current ½ month	£72½	£72½
Three months	£73½	£73½

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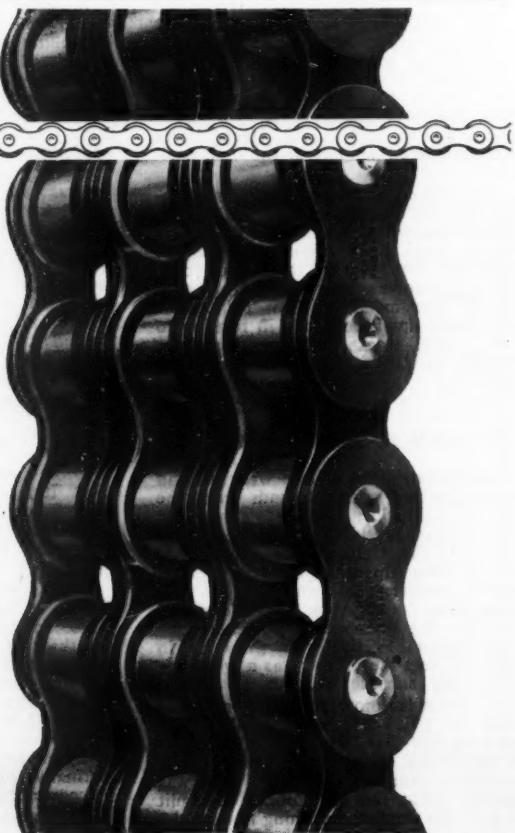
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Mining Finance

Rhodesian Dividend Season

If the Rhodesian dividend season has proved to be a surprise then it is a pleasant one. Despite the increase in both the Federal tax rate and the Northern Rhodesian territorial surcharge, together an additional 6d. in the £, the Rhokana and Rhoanglo net dividends have been maintained. The Bancroft dividend has been reduced from 1s. to 9d. net, but this is rather as anticipated.

In the Rhodesian Selection Trust group, which declares its dividends gross, there has been a reduction in all cases except that of the Ndola Copper Refineries, but the reductions have not on the whole been any greater than anticipated.

The operating profits of all the companies have fallen over the year to June 30, 1961 due largely to the voluntary 10 per cent sales cut that has been in operation since October 1, 1960. Compared with the previous year, however, there has been little change, on average, in the price received for the metal. At Rhokana the operating profit, before tax, fell from £11,241,928 to £9,507,441, whilst at Mufulira and Roan Antelope the profits before tax fell from £9,954,107 to £7,727,336 and from £7,099,519 to £5,023,590 respectively.

Rhokana Corporation is a large operating company, having the largest custom smelter in the world, yet it is also a holding company and it is largely due to its increased investment income that it has been able to maintain its dividend.

Rhokana's investments are all in the other Copperbelt mines and thus in the long run they also reflect the operating results of the industry but as Rhokana's investment income in any one year reflects mainly the other company's operating results for the previous year the effect is to provide a more even dividend distribution rate. The increase in investment income this year from £4,222,350 to £4,868,552 is due to the inclusion of the Bancroft maiden of 1s. The presence of this maiden dividend is also important when considering Rhoanglo, whose net profits have fallen only from £10,160,915 to £9,356,191.

R.S.T. has a 64.7 per cent interest in Mufulira and its fortunes therefore tend to follow this great mine. The group net profit before taxation was £7,745,333 compared with £10,896,942 for the previous year, the total dividend payment before tax has fallen by 4½d. to 1s. 1½d., whilst the Mufulira payment has fallen by 1s. 10½d. to 6s.

At present, the ups and downs of the Rhodesian copper industry in terms of the demand for copper seem to have little effect on the London market. This is the result of the political situation, both in Northern Rhodesia itself and in the neighbouring Katanga. Up to a point this is understandable, but the discount due to politics is definitely too high.

At present, the yield on these shares is in the order of 14 per cent and, allowing

for the maximum D.T.R. for an effective rate of 7s. 6d., this can be increased to 22 per cent. Realising that the outlook for copper in the longer term is encouraging (see *Mining Journal*, September 22, 1961) and that several of the mines have considerable growth prospects, particularly Mufulira, these shares can only be described as dirt cheap. Certainly, the yield on R.S.T. does discount this growth factor with a much lower yield, but a reasonable interest in Mufulira can be purchased through Rhokana which has a 26.6 per cent holding in Mufulira.

The main reason for the Rhodesian coppers staying so low seems to be continental selling, and as this scrip is being quickly absorbed in London, it is to be presumed that should the continental tap stop, then the London price would move ahead quite sharply.

EXTRA FUNDS FOR WESTERN MINING

Western Mining's diversification programme is indeed an ambitious project and will give the corporation substantial interests in both aluminium and iron ore. The programme itself was discussed in these columns on September 8, 1961, at the same time as the report and accounts were analysed. However, at that stage it was not known how much money the diversification was to cost, nor the manner in which the money was to be raised.

In addressing the annual meeting in Melbourne, the chairman said that the money would be raised by a rights issue of deferred shares. The issue will be in the proportion of 60 shares per 100 held at A12s. 6d. per share. The initial payment will be A2s. 6d. per share and the balance will be called up over the next two years. By making the issue deferred it enables the company to continue making the tax-free dividends on the present issue.

This rights issue will raise £A1,490,000 and will enable Western Mining to finance its agreed participation in the Alcoa project and will also provide funds for its iron ore projects. The corporation has been granted six iron ore reserves by the government, and eventually additional finance will be required for this project. However, at present the directors have decided that the question of raising further capital must await the results of the prospecting.

Already the company has discussed the marketing of iron ore with representatives of the Japanese steel mills and have received an assurance that the Japanese market can absorb any tonnages that they are likely to supply.

Prospecting has already begun on the reservations in the Geraldton district, i.e., the Talling Range area and the Morawa reserve, and it is planned, should a satisfactory deposit be proved, to establish an export route through the port of Geraldton. The second group of reserves is in the Yilgarn area and will be served by the port at Fremantle.

KALGOORLIE AND KALGOORLIE SOUTHERN

During the year ended March 31, 1961 calls totalling 1s. per share have been made, and with the exception of those which have been forfeited, the Kalgoorlie Southern shares are now all fully paid. This brings the number of fully-paid shares in issue to 1,414,045. During the

London Market Highlights

The South African gold share market, which has been sorely in need of a tonic for a long while now, brightened considerably at the beginning of the week when the first news filtered through of a new U.S. Kaffir trust. It was understood to be an open-end trust and its purpose was to provide a convenient way for U.S. investors to take advantage of the high yields currently offered on leading Kaffir shares. The implications of the fact that gold share prices are much cheaper in London than at the Cape was not lost on the market here; the possibility of the new trust coming to London for its initial portfolio soon sent the bears scurrying for cover and induced a quiet marking up of prices by jobbers who were still rather sceptical of the whole thing.

Perhaps the jobbers were right, because no sign of U.S. buying was seen and it was later learned that the new trust was, at the moment anyway, a very modest affair. Even so prices held their modest gains remarkably well despite the dullness that engulfed industrial sections on Wednesday. As far as Kaffirs were concerned, the onset of the September quarterly reports was a helpful factor. Among the first received, that of St. Helena could hardly have failed to make a favourable impression and the shares moved up from 57s. 9d. to 59s. 4½d. before reacting to close at 58s. 9d. Free State Geduld were especially firm (after all, any U.S. trust would be bound to include them in an initial Kaffir portfolio) and aided by hopes of another good quarterly the shares moved forward and

strengthened to 88s. 9d. from 82s. 6d.

There were several other firm spots and the happier mood of the market was fully reflected in Anglo American which put on 5s. in three days to close at 125s. 7½d. on Wednesday evening. "Ofsits" improved from 58s. 9d. to 61s., but Lydenburg did not stray far from 11s. 7½d.; a reflection perhaps of the lack of enthusiasm felt by shareholders of the latter stock over the Anglo American offer of one "Ofsits" for every five Lydenburg.

While Kaffirs were looking more cheerful, tins also began to look a little brighter in response to a drying up of the persistent Singapore selling in this market in recent weeks. Ayer Hitam, which have been a particular Far Eastern target, recovered 1s. 6d. to 43s. 6d. and Sungai Besi were similarly better at 42s. 6d. The latest interim dividend from Gopeng could only be described as excellent and the shares improved 1s. to 41s. and that of Tanjong which was encouraging caused these shares to harden to 23s. 9d.

Copper shares did little more than maintain the better prices which had mirrored the previous week's better-than-expected dividends from the Copperbelt. Otherwise, the main interest centred on Broken Hill South. On Tuesday, share-dealers raised the price by 1s. to 13s. 9d. following a rather surprising revival of Australian interest in the 1s. units. Wednesday's news of a mystery bid of £A17,500,000 for the company explained the revival and the stock unit price climbed to 14s. 6d., the bid being equal to about 17s. 6d. per unit.

current year, however, the company's funds have been exhausted, and the present operations are being financed by loans from Gold Mines of Kalgoorlie. This company has agreed to lend up to £A15,000 in return for an option over 50,000 of the forfeit shares at par. Should this option be exercised, the number of remaining forfeit shares would be reduced to 7,755. As a result of the calls made during the past year, the interest of Gold Mines of Kalgoorlie, in Kalgoorlie Southern has been increased by £9,131 to £88,155.

At the annual meeting, Mr. G. Lindsey Clark, chairman of Kalgoorlie Southern, announced some results from the bore-hole S.E.12. At 6,517 ft. the core assayed 3.9 dwts. over 9 inches; at 6,669 ft. 2.8 dwts. over 19 inches; at 6,772 ft. 2.7 dwts. over 12 inches; at 6,797 ft. 3.1 dwts. over 17 inches and at 6,810 ft. 6.15 dwts. over 13 inches. It is anticipated that it will be necessary to take this hole to at least the 8,000 ft. mark in order to achieve the object of testing whether or not there is an anticline to the east of the Cavalier Syncline. If an anticline is discovered, then it will be explored for lodes of the Kalgoorlie type.

Extracts from the chairman's statements of Western Mining, Gold Mines of Kalgoorlie and Kalgoorlie Southern are published on page 384.

C.P.M.O.'S NEGOTIATIONS WITH INDIAN GOVERNMENT

Further to our note in these columns on April 28 (page 485) regarding the protracted negotiations between the Central Provinces Manganese Ore Company and the Indian Government, it seems possible that the company may now be within sight of concluding a definite agreement.

In a statement to stockholders on August 22, following the return of the company's representatives from a series of discussions in New Delhi, it was indicated that certain broad principles had emerged from these negotiations which the Board considered would be acceptable as a basis for an agreed solution.

The circular stated that the formal approval of the Indian Government to these points of principle had not at that time been received as other authorities not directly concerned with the negotiations had yet to be consulted.

It would seem a reasonable guess that these authorities were the Governments of Maharashtra and Madhya Pradesh from which the C.P.M.O. had been seeking to renew its leases.

We understand that representatives of the company are shortly to return to India to resume negotiations which seems to indicate that the consultations between the Government of India and other Indian interests have been concluded.

Support for believing that C.P.M.O. may now be closer to reaching a workable agreement with the Indian Government is forthcoming in a report published in *The Statesman* of Calcutta (overseas edition of September 30). In outlining what it believes will prove to be the terms of the agreement, *The Statesman* suggests that it is intended to form a new Indian company for the future operation of C.P.M.O.'s lease areas in which the Indian authorities would hold 51 per cent of the equity. The report suggests that C.P.M.O.'s 49 per cent interest in the new company would be allotted in exchange for its present assets (this pre-

sumably means its fixed assets plus mine stores) and that the Government's investment would be in rupees. There is no indication in the report as to whether C.P.M.O. was expected to receive any compensation for loss of control and the dilution of its equity interests.

According to *The Statesman* the C.P.M.O. would be appointed the sole selling agent of the new company which would be concerned only with the operation of the manganese mines. C.P.M.O. has long established connections in the world manganese market and it is clearly good sense that the Indian Government should be anxious not to disturb unnecessarily the goodwill existing between C.P.M.O. and its customers.

It should be emphasised that the report in *The Statesman* can at this juncture be no more than an intelligent, and doubtless informed, guess at the outcome of the further negotiations upon which C.P.M.O.'s representatives are about to embark. Meanwhile, shareholders would do well to remember that as yet, no final agreement has been reached and that they are assured of a full report from their Board once this has been achieved.

OFSITS IN EXCHANGE FOR LYDENBURG

The full details of the offer of one Ofsit share for every five Lydenburg shares have now been published and they do not completely dispell some of the doubts that have been expressed about the offer.

The main complaints arise from the fact that whilst the offer seems generous in terms of the current market prices of the two companies themselves, when the supporting investments are reviewed the picture is slightly different. The assets of both Lydenburg and Ofsit are given in detail in the annual reports and it is therefore possible, assuming that the changes since the financial year end have been small, to calculate the asset value fairly accurately. On this basis it can be shown that the Lydenburg holders are being offered assets worth 68s. in return for 70s. worth.

This, however, is only one way of valuing a share offer. There are many other factors which must be considered. The Ofsits are far more marketable than the Lydenburg shares and Ofsit offer a wider investment spread with a reasonable interest in new developments. Some will argue that Lydenburg also has its share of growth outlook and participations, but the important factor is that Ofsit has larger resources from which to follow up any opportunities.

Taken over all it is not a generous offer but it can hardly be described as unfair. It does not contain that element of incentive that today, shareholders have come to associate with take-over bids, and this is probably why some complaints have been raised. The point is, if the offer is rejected now, is it likely to be any better in the future, probably not.

SOUTH AFRICAN PROFIT RECORDS

In the monthly returns for September, published in tabular form on page 383 eight mines in all show new record profit levels. The most outstanding is West Driefontein with a new record of £R2,544,000. This is not only an all-time high for the mine, but also for the industry. The other record breakers were

Doornfontein, F. S. Geduld, Libanon, Luipaards Vlei, Western Holdings, and F. S. Saaiplaas.

At the other end of the scale Blyvoortuizicht has recorded its lowest profit level for over two years. Overall, the profit levels have declined slightly as compared with the month of August, and this is due to several factors, amongst which is the seasonal fall-off in the labour force and the slightly lower price obtained for gold.

Operations at City Deep were affected by a mishap in August to the 4c Incline hoist, which was not re-commissioned until September 18, and also the loss of the rock hoist at No. 1 shaft, Nourse section, from September 13. This is due to cracks which have developed in the hoist draw.

AMERICAN INTEREST IN KAFFIRS

It has been reported from the United States that a new fund to be known as the Rand American Fund Inc. is to be formed. It is understood that this fund is, in the first place, to be private but it is hoped that it will be built to a substantial size. It is to establish a portfolio of Kaffir shares mainly with the object of receiving the substantial dividends that are available from the high-yielding South African shares. Its appeal will probably be to American investors in the lower and middle income bracket.

The operation of this fund is quite different from that of the American South African Investment Company which invested in Kaffirs for growth rather than dividends. The other main difference is that while the A.S.A.I.C. purchased its shares in Johannesburg and therefore its investment represented a new capital flow into South Africa and it was able to negotiate certain guarantees, the new fund is to purchase its portfolio in London.

This could be of great significance to the London market but at present the major unknown about the fund is its capital resources. Until this is known neither its effect in London nor its meaning in terms of American investment opinion can be judged. The sponsoring organisation is Investment Incorporated.

BID FOR BROKEN HILL SOUTH

A bid has been made to acquire all the capital of Broken Hill South, the directors announced this week. They stated that before any consideration could be given to the approach, the identity of the party or parties concerned, and their financial status, must be made known. The *Sydney Sun* reported that the offer, believed to be worth more than £A16,000,000, came from an overseas financial group, and exceeded 20 Australian shillings a share. Broken Hill South shares closed at 18s. 9d. on Sydney stock exchange on Wednesday, after rising 10s. under keen bidding.

Broken Hill South later announced that they were re-opening their copper mines at Cobar, in western New South Wales, formerly one of the largest copper producing fields in Australia. The mines are expected to produce medium-grade copper in large quantities.

★

The directors of Geevor Tin Mines regret to announce the death of Mr. J. H. Bennetts, a director of that company.

Book Reviews

In the Kirghiz Steppes, by John Wilford Wardell. Published by Gallery Press Ltd., 10-13 Bedford St., Strand, W.C.2. pp. 190. Price 25s.

For five years the author worked in the steppes of Southern Siberia, now called Kazakhstan, mining copper for the Tsarist government and later for Admiral Koltchak. Anyone who imagines that free enterprise existed in the Tsars' reign will be disillusioned on reading the regulations concerning the specification of workers' dwellings in mining "company towns". From the standpoint of mining and economics, however, the value of this graphic record lies mainly in the vivid descriptions of conditions in what is now one of the most important mining regions in the U.S.S.R.

★

An illustrated booklet entitled *This is Cyanamid* has been produced by Cyanamid International, a division of American Cyanamid Co., 30 Rockefeller Plaza, New York, 20 N.Y. Cyanamid was formed in 1907 to introduce the first synthetic nitrogen fertilizer to the Western Hemisphere. Today, it produces more than 6,000 different chemicals or drug products. Outside the U.S. and Canada it has more than 20 subsidiary and associated companies. Among these is Cyanamid of Great Britain Ltd., with administrative headquarters at Bush House, Aldwych, London, W.C.2 and a 30-acre plant at Gosport, Hampshire, where manufacturing and distribution are centred. The mining chemicals produced by the group include "Aerobrand" cyanide for gold extraction, cyanides for refining gold and silver, flotation chemicals, and chemical grouting compounds. Cyanamid's industrial explosives are widely used in mining and quarrying.

★

The properties and uses of diamonds are described in *Diamonds in Industry—an Introduction*, a brochure issued by the Industrial Diamond Information Bureau, 2 Charterhouse St., London, W.C.1. The booklet begins with a brief introduction on the formation of diamonds under intense heat and pressure; on the historical uses of diamonds; and on the selling organization through which they are distributed. Following this, a section is devoted to the property which makes diamond industrially valuable—its extreme hardness. The exploitation of this property throughout the whole range of industrial applications is surveyed: for lathe tools, grinding, glass-working, sawing, drilling, gem polishing, honing and lapping, dressing and truing and wire drawing. In each case the appropriate type of diamond material for the job is described.

The Proprietors of British Patent No. 777,619 for "An Improved Pit Prop", desire to enter into negotiations with a firm or firms for the sale of the Patent or for the grant of Licences thereunder. Further particulars may be obtained from Marks & Clerk, 57/58, Lincoln's Inn Fields, London, W.C.2.

Rand and Orange Free State Returns for September

GOLD OUTPUT AND PROFIT

Company	Tons (000)	Sept. 1961			Year ends	Current Financial Year Total to date			Last Financial Year Total to date		
		Yield (oz.)	Profit† (R000)	Year ends		Tons (000)	Yield (oz.)	Profit (R000)	Tons (000)	Yield (oz.)	Profit† (R000)
Gold Fields											
Doornfontein	125	54,056	668-0	J	374	161,186	1920-6	315	129,219	1341-1	
Libanon	119	30,901	182-8	J	357	28,446	529-3	351	83,831	404-5	
Rietfontein	12	3,106	3-4	D	108	408	27-2	140	46,990	105-6	
Robinson	51	10,060	3-3	D	404	87,945	25-7	402	89,103	10-2	
Simmer & Jack	72	12,357	2-2	D	633	113,080	7-7	683	121,210	L87-7	
Sub Nigel	66	15,162	25-3	J	199	45,326	78-2	199	45,580	89-7	
Venterspost	130	39,332	209-8	J	385	116,599	616-6	374	104,476	463-7	
Vlakfontein	53	19,626	186-3	D	472	174,407	1674-7	465	167,012	1577-5	
Vogels	80	17,284	130-0	D	725	155,595	349-6	770	165,672	365-8	
West Drie	182	42,860	2272-2	J	544	426,045	7152-7	390	377,883	6464-2	
Anglo American											
Brakpan	142	18,896	65-8	D	1,289	154,288	453-9	1,286	155,697	224-8	
Daggas	224	45,566	444-5	D	2,030	410,896	4072-7	2,083	420,979	427-2	
East Daggas	108	18,717	90-3	D	968	165,729	767-3	949	161,242	735-8	
F.S. Geduld	99	87,095	1412-6	S	1,163	1,013,816	16487-4	1,130	973,462	1599-7	
President Brand	133	103,085	1744-3	S	1,484	1,66,850	20101-1	1,395	1,136,276	19929-1	
President Steyn	112	42,150	332-5	S	1,301	487,610	4053-6	1,222	470,874	4192-3	
S.A. Lands	113	22,792	102-2	D	976	197,343	913-5	876	182,093	814-6	
Sinclair	97	14,263	50-5	D	847	120,257	356-7	913	126,981	253-9	
Vaal Reefs	118	55,695	566-5	J	974	456,340	4883-5	888	406,612	4189-6	
Welkom	105	33,531	140-5	S	201	301,719	1620-5	1,183	373,689	1813-5	
Western Holdings	175	122,503	2096-3	S	2,001	1,777,336	23536-3	1,778	1,778,335	19455-1	
West Reefs Ex.	135	45,182	310-4	D	1,358	395,227	2699-9	1,261	356,410	2372-2	
Central Mining											
Blyvoor	140	86,828	1308-2	J	428	263,058	3975-9	404	262,689	3962-3	
City Deep	112	23,456	L6-1	D	1,031	212,374	39-8	1,027	210,300	96-9	
Cons. M.R.	39	8,764	3-0	J	117	26,477	9-2	174	35,162	25-3	
Crown	178	31,382	2-5	D	1,626	283,758	23-8	1,806	305,736	114-7	
D. Roodepoort	196	36,663	102-0	D	1,743	324,076	906-8	1,736	317,854	894-5	
East Rand Prop.	235	57,025	205-1	D	2,137	487,398	1389-4	2,003	489,492	1482-2	
Harmony	194	78,286	746-7	J	598	240,989	2332-1	502	202,107	1872-7	
Modder East	62	6,464	0-6	J	186	19,294	L0-8	391	37,916	L1-1	
Rose Deep	25	4,209	0-6	D	209	36,784	L2-7	220	38,915	17-5	
J.C.I.*											
Freddies Cons.	65	13,317	L36-9	D	574	118,837	L393-2	545	120,219	L704-6	
Govt. G.M.A.	34	7,650	L19-6	D	351	72,674	L153-7	475	97,032	9-1	
Randfontein	16	3,097	1-1	D	153	27,584	12-4	212	41,675	51-7	
Union Corporation											
East Geduld	122	34,282	413-2	D	1,133	321,211	3882-3	1,190	348,249	4451-4	
Geduld Prop.	75	12,558	34-1	D	706	113,941	366-6	672	117,137	427-6	
Grootvlei	225	46,539	466-3	D	1,967	407,049	4011-2	1,955	406,536	4157-1	
Marievale	99	23,520	239-4	D	887	213,194	2169-3	889	217,494	2272-2	
St. Helena	185	64,758	844-8	D	1,654	579,847	7468-1	1,476	501,474	3115-1	
Van Dyk	75	10,907	4-8	D	667	103,421	102-1	663	109,145	158-4	
Winkelhaak	98	33,311	357-8	D	860	292,630	4155-4	783	249,053	2416-2	
General Mining											
Buffelsfontein	156	68,584	770-0	J	463	203,045	2290-1	441	181,442	1956-1	
Ellatton	23	5,535	26-5	D	217	51,019	268-6	256	60,571	446-5	
S. Roodepoort	30	7,313	45-0	J	91	22,078	136-0	91	21,781	138-9	
Stilfontein	185	83,100	871-7	D	1,604	724,121	7757-3	1,454	656,566	6953-9	
W. Rand Cons.	134	19,863	37-5	D	1,211	178,946	309-8	1,192	171,306	152-0	
Anglo Transvaal											
Hartbeesfontein	136	62,356	689-9	J	408	187,476	2093-8	360	167,698	1918-0	
Lorraine	85	28,900	143-0	S	999	271,155	351-2	947	198,582	L449-4	
Rand Leases	180	25,020	L11-3	J	564	72,244	L45-8	576	83,324	64-1	
Village M.R.	37	4,533	L2-7	J	110	13,201	L9-2	89	13,046	L24-2	
Virginia O.F.S.	143	28,572	L33-5	J	426	83,925	L237-7	321	67,577	L283-9	
Others											
N. Kleinfontein	65	9,844	2-5	D	650	90,748	44-1	710	91,497	8-8	
Wit. Nigel	19	4,275	6-6	J	58	12,825	20-2	60	13,300	31-4	

Gold has been valued at R24.99 (August R25.03) per oz. fine. L indicates loss. † Working Profit. Table excludes profits from Uranium, Pyrite and Acid, and also production from Uranium divisions at Randfontein and W. Rand Consolidated. * Working profit includes Sundry revenue.

ESTIMATED URANIUM REVENUE

Company	Year ends	Sept. (R000)	This year (cum.) (R000)	Last year (cum.) (R000)	Company	Year ends	Sept. (R000)	This year (cum.) (R000)	Last year (cum.) (R000)
Gold Fields									
Doornfontein	J	32-0	96-0	90-0	J.C.I.				
Luijendaal Vlei (a)	J	268-0	798-0	562-2	E. Champ d'Or (a)	D	9-0	85-1	122-1
Vogels	D	105-0	981-0	972-0	Freddies Cons. (b)	D	65-0	584-0	568-0
West Drie	J	103-0	307-0	294-0	Govt. G.M.A.‡	D	30-0	414-8	414-8
Anglo American									
Daggafontein (b)	D	252-0	2299-0	2531-3	Randfontein (b)(c)	D	279-8	2504-6	1893-4
P. Brand (b)	S	92-0	1080-8	1096-5	General Mining	J	252-1	766-7	1276-0
P. Steyn (b)	S	130-0	1491-2	1470-0	Buffelsfontein (d)	D	3-5	33-7	306-0
Vaal Reefs (b)	D	148-0	1329-8	2550-6	Ellatton (d)	D	10-8	262-3	1602-0
Welkom (b)	S	121-0	1414-1	1399-3	Stilfontein (d)	D	201-4	2653-2	3737-1
West Reefs Ex. (b)	D	102-0	899-2	2916-8	Anglo Transvaal	J	440-0	1291-0	1484-0
Central Mining									
Blyvoor (b)	J	155-0	480-0	972-0	Lorraine (d)	S	69-5	813-5	832-0
Harmony (b)	J	384-9	1170-0	1521-1	Virginia O.F.S. (d)	J	266-4	813-5	1021-7

Table includes profit from uranium, acid and pyrite, before loan redemption. (a) Including profit from gold section. (b) Including royalty provision. (c) Total profit from uranium section. (d) Excluding royalty provision.

* Net revenue. † Uranium royalty received. ‡ Pyrite.

WESTERN MINING CORPORATION

The annual general meeting of Western Mining Corporation Limited was held on September 27 in Melbourne.

Mr. G. Lindesay Clark, C.M.G. (the Chairman) presided and paid tribute to the memory of the late Mr. Leslie Edwards, a Director of the Company, who died on November 29, 1960.

(All figures quoted are in Australian currency.)

Net profit for the year ended March 31, 1961 of £297,568 was £42,188 higher than for the year 1959/60. Dividends received from the Central Norseman and Gold Mines of Kalgoorlie companies were unchanged and the principal reasons for the increase in profits were reductions in the amount of investigations written off and in administration charges and interest.

Gold Mining

Production by the three gold mining companies in the Group totalled 1,127,024 tons, yielding 309,883 ounces of fine gold in bullion and concentrates. A further 1,893 tons of ore, from which 1,643 ounces of fine gold were recovered, was mined by tributaries working the Yilgarn Queen Mine.

Operations at Central Norseman Gold Corporation N.L. and Gold Mines of Kalgoorlie (Aust.) Ltd. continued this year with satisfactory developments and dividends were maintained at the level of the previous year.

Great Western Consolidated N.L. suffered a loss on its operations and is now in the stage of mining and treating its residual ore reserves.

Aluminium

Commenting on prospecting for minerals other than gold the Chairman said: When it became apparent that an important bauxite deposit had been discovered in Western Australia it was thought that we might hope to develop an export trade in bauxite which could lead later to the erection of a refinery to produce alumina.

Following extended negotiations, we had the great good fortune to interest the Aluminum Co. of America in joining us in establishing an integrated aluminium industry through the formation of Alcoa of Australia Proprietary Limited to develop these resources. Your Directors look forward to the future of Alcoa of Australia with the greatest confidence.

Iron Ore

For some time the Corporation has been interested in the iron ore resources of Western Australia. Recently the Government has decided to grant reserves over certain deposits and six reserves have been granted to the Corporation.

The market for iron ore is the expanding steel industry in Japan. We have recently had conversations with representatives of steel mills in Japan and are assured that their market can absorb any tonnages that we are likely to be able to supply.

Capital

Your Board has given a great deal of consideration to the manner in which the finance for the ventures which have been mentioned should be provided.

The Board considered that if people subscribed to separate companies establishing new industries, such as Alcoa of Australia and iron ore, they would not expect dividends for some years in any event. It was thought, therefore, that the situation could be best met by issuing deferred shares which would enable the tax-free dividends to be continued on the present issue.

On this basis the Board now proposes to make a rights issue of 60 per 100 at 12/6d. per share, due for dividend in August 1964. The payment for these shares will be 2/6d. down, the remainder in calls over approximately 2 years.

The report and accounts were adopted.

GOLD MINES OF KALGOORLIE (AUST.)

The annual general meeting of Gold Mines of Kalgoorlie (Aust.) Limited was held on September 21 in Melbourne.

Mr. G. Lindesay Clark, C.M.G. (the Chairman) presided and, in the course of his speech, said :

(All figures quoted are in Australian currency.)

Net profit for the year ended March 31, 1961 was £281,917 compared with £323,869 for the year 1959/60, a decrease of £41,952. This decrease was caused mainly by an increase in operating costs, consequent upon higher labour costs and a higher proportion of cut-and-fill stoping compared with the previous year.

Calls of 1/- per contributing share were made during the year by Kalgoorlie Southern Gold Mines No. Liability, and have increased this Company's interest in the project by a further £9,131 to £88,155. Since the close of the year a loan of up to £15,000 has been made available to Kalgoorlie Southern, in return for which, an option over 50,000 forfeited shares at par has been granted.

A dividend of 1/- per share absorbing £202,265 was paid on December 1, 1960. Since the close of the year the Company has recommended consideration of dividends half yearly, and a dividend of 6d. per share was paid in May, 1961.

Operating Results

The mill treated 530,138 tons for the year including 441 tons of customs ore, an average of 40,780 tons per four weekly period, an increase of nearly 500 tons per period over the corresponding figure last year.

Gold recovered amounted to 144,411 fine ounces, being 134,005 ex Mill, 10,324 from concentrates treated at Fremantle and 82 from clean-up of shut down mills. Gold in concentrates awaiting treatment at Fremantle increased by 2,331 ounces.

The head grade from the mines for the year averaged 6.16 dwts. per ton and the residues 0.62 dwts., giving an overall recovery of 90.0%.

Ore Reserves at March 31, 1961, were estimated at 1,133,000 tons averaging 5.9 dwts. per ton, compared with 1,287,000

tons averaging 5.8 dwts. per ton in March, 1960.

During the year 31,708 feet of development was done, of which 1,195 feet was special work in connection with shafts, haulage connections and ore passes. Of the 30,513 feet of normal development, 23% was in ore averaging 9.2 dwts. over 65 inches. Between the end of the year and August 15, 1961, 10,992 feet of normal development has been done, of which 27.4% was in ore averaging 10.1 dwts. over 64 inches.

The report and accounts were adopted.

KALGOORLIE SOUTHERN GOLD MINES NO LIABILITY

The annual general meeting of Kalgoorlie Southern Gold Mines No Liability was held on September 21 in Melbourne.

Mr. G. Lindesay Clark, C.M.G. (the Chairman) presided and, in the course of his speech said :

(All figures quoted are in Australian currency.)

As a result of the much higher footage of drilling, the expenditure on drilling, geological work, lease rents, etc., increased by £18,301 to £38,830.

Calls totalling 1/- per share were made during the year, making all shares fully paid, with the exception of the forfeited shares in the hands of the Company.

Since the close of the year, the funds of the Company have been exhausted and present operations are being financed by loans from Gold Mines of Kalgoorlie (Aust.) Limited which has agreed to provide up to £15,000 in return for an option over 50,000 forfeited shares at par.

Development: Since the Annual Report was written, hole S.E.12 has continued in quartz dolerite greenstone from 6,443 feet to its present depth of 7,520 feet. From 6,443 feet to 6,811 feet, the core shows a general tendency to shearing and alteration; from 6,811 feet to 7,520 feet the quartz dolerite is more massive and less altered.

The following results have been obtained from core sent for assay: at 6,517 feet; 9 inches at 3.9 dwts. per ton, at 6,669 feet; 19 inches at 2.8 dwts. per ton, at 6,772 feet; 12 inches at 2.7 dwts. per ton, at 6,797 feet; 17 inches at 3.1 dwts. per ton and at 6,810 feet; 13 inches at 6.15 dwts. per ton.

Kalgoorlie Southern: The drill has upwards of 1,000 feet still to go to reach the expected eastern flank of the Cavalier syncline.

The report and accounts were adopted.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY

A Grace Madeline Beatty Scholarship, value £400 per annum, tenable at the Royal School of Mines is available for a three-year course in Mining Geology or Mining, preferably the former, leading to the award of the A.R.S.M. and the B.Sc. (Hons.) Degree. Further particulars and application forms from the Registrar, Imperial College, London, S.W.7, to be returned by March 31, 1962.

